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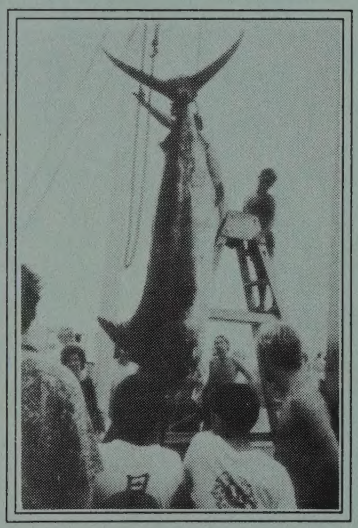
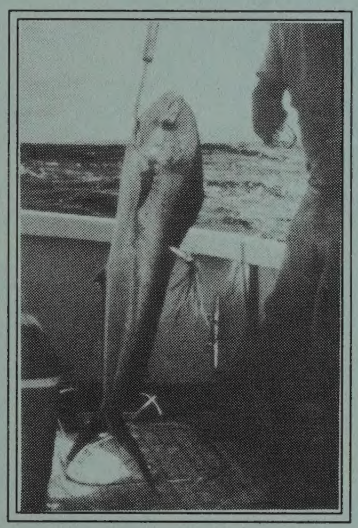
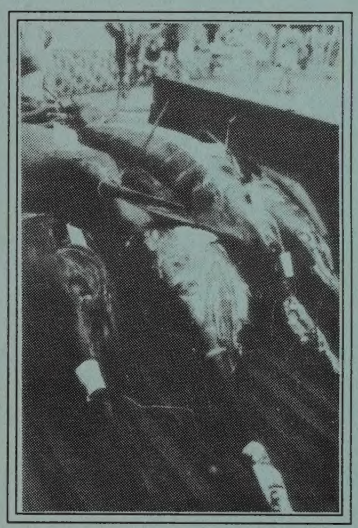
Second Annual Report

PELAGIC FISHERIES of the WESTERN PACIFIC REGION

Covering 1988 and Earlier Years

December 1989

Prepared by the Plan Monitoring Team for the

Western Pacific Regional Fishery Management Council

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GLOSSARY OF TERMS

Abundance The number of fish of a species present in an area of interest over a specified unit of time.

Catch The number or weight of a particular species or group of species taken in a unit of time, whether retained or landed.

Catch-Per-Unit of-Effort (CPUE) Generally defined as the average catch taken by a defined unit of fishing effort. For PMUS, CPUE will be calculated as the weight of pelagic species landed per unit of effective effort.

Catch Rate See CPUE

CNMI Commonwealth of the Northern Mariana Islands.

DAWR Guam Division of Aquatic and Wildlife Resources.

DFW Commonwealth of the Northern Mariana Islands Division of Fish and Wildlife.

DMWR American Samoa Department of Marine and Wildlife Resources.

Effective Effort An effective fishing trip for each species or species category appearing in tabular summaries is defined as a trip which resulted in the landing of that species or species category. For purposes of calculating CPUE, effective effort for any species or species category is defined as a trip which resulted in the landing of any PMUS or tuna.

Effort or Fishing Effort A numerical measure of the amount of gear and time used in an attempt to catch fish. Effort may be expressed in terms of number of hooks fished per day, number of boat days, man hours, line hours, etc.

Exclusive Economic Zone (EEZ) U.S. waters from the seaward boundary of a State or Territory to 200 nautical miles from the shoreline.

Fishery A fishery is a composite of the following essential components: a resource consisting of a population of a species or set of species usually with similar ecological requirements or characteristics; a number of fishermen who regularly exploit the resource, together with their boats and equipment for harvesting and handling fish; and a market in which fishermen can sell their catch.

Fishery Management Plan (FMP) — A plan prepared by the Council and implemented by the U.S. Department of Commerce for the conservation and management of fishery resources in the Exclusive Economic Zone.

HDAR — Hawaii Division of Aquatic Resources, Department of Land and Natural Resources.

Magnuson Fishery Conservation and Management Act (MFCMA) — Federal law (P.L. 94-265, passed in 1976 and amended several times in subsequent years) covering fishing activity in U.S. waters between State waters and 200 nautical miles from the coastline.

Management Unit — A species or a group of fish species affected or exploited by the same fishery or fisheries.

Maximum Sustainable Yield (MSY) — The greatest average amount, in theory, that can be harvested from a population of fish on a continuing basis.

Mortality — Refers to the death rate in a population from natural and fishery causes. Together these constitute total mortality. Mortality rates can be considered on an instantaneous or an annual basis (instantaneous mortality rates are the limits approached by average rates over progressively shorter periods).

NOAA Fisheries — The National Marine Fisheries Service, located within the National Oceanic and Atmospheric Administration, has the primary Federal responsibility for the conservation, management, and development of living marine resources and for the protection of certain marine mammals and endangered species under numerous Federal laws. The Agency also has responsibilities to the U.S. commercial and marine recreational fishing industry, including fishermen, and to the States and the general public.

Northwestern Hawaiian Islands (NWHI) — The Hawaiian Islands archipelago lying to the west of 161° 20' W. longitude.

Optimum Yield (OY) — The amount of fish which produces maximum benefits to the Nation, especially considering food production and recreational opportunities.

Overfishing — A term often used to describe fishing at a level of effort in excess of the level needed to obtain the MSY. The term is also used to imply that fishing has reduced stock to such a level that its reproductive potential is reduced. Overfishing may occur in a fishery at different levels of effort for recreational and commercial users. This may occur, for example, when recreational users prefer fish of smaller size than commercial users.

Plan Monitoring Team (PMT) — A team appointed by the Council to monitor the fishery and to prepare annual reports under the direction of the Council. The PMT utilizes inputs from all committees and panels as well as outside sources in developing the annual reports.

PMUS — Pelagic management unit species are those species covered by the Council's Pelagics FMP. They are listed in the introduction.

Stock — A population or portion of a population that can be treated as a single unit for management purposes.

Western Pacific Regional Fishery Management Council (Council) — The Western Pacific Regional Fishery Management Council consists of public and private members from the State of Hawaii, the territories of American Samoa and Guam, and the Commonwealth of the Northern Mariana Islands and members from Federal Agencies. It has authority over the fisheries in the Pacific Ocean seaward of the jurisdiction of such State, territories, Commonwealth, and possessions of the United States in the Pacific Ocean area out to 200 nautical miles from shore.

INTRODUCTION

The Fishery Management Plan (FMP) for the Pelagic Fisheries of the Western Pacific Region was implemented by the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA Fisheries) on March 23, 1987. The Western Pacific Regional Fishery Management Council (Council) developed the FMP to manage the pelagic resources covered by the Magnuson Fishery Management and Conservation Act of 1976 and occurring in the exclusive economic zone (EEZ) off the coasts of American Samoa, Guam, Hawaii, and U.S. possessions in the western Pacific (fishery management area). The management goal of the pelagic FMP is to maintain pelagic stocks at optimal population levels while managing foreign fishing, promoting equitable domestic utilization of the resources by commercial, subsistence, and recreational sectors, eliminating waste from incidental harvest, and diminishing the risk of gear conflicts.

The pelagic management unit species (PMUS) covered by this FMP are given below.

Common Name	Scientific Name
Mahimahi (dolphinfish)	Coryphaena hippurus
Pompano dolphinfish	C. equiselis
Wahoo	Acanthocybium solandri
Indo-Pacific blue marlin	Makaira mazara
Black marlin	M. indica
Striped marlin	Tetrapturus audax
Shortbill spearfish	T. angustirostris
Swordfish	Xiphias gladius
Requiem sharks	Carcharhinidae
Thresher sharks	Alopiidae
Hammerhead sharks	Sphyrnidae
Mackerel sharks	Lamnidae

PMUS are generally caught by trolling and using tuna longline gear in pelagic waters, particularly oceanic waters but insular as well. Most of these species are considered to be epipelagic because they occupy the upper most layers of the pelagic zone. All are high predators in the trophic sense. Pelagic fisheries, for PMUS and tunas, are generally important, if not the most important, components of many Pacific island fisheries.

The pelagic FMP requires that the Council's Pelagic Plan Monitoring Team (Team) prepare an annual report on the status of the pelagic fisheries taking place in each of the island areas served by the Council and evaluate the effectiveness of the FMP in meeting its goals and objectives. The FMP requires that the following topics be addressed in the annual report to assess the status of the pelagic fisheries in each of the four western Pacific island areas (American Samoa, Guam, Hawaii, and Northern Mariana Islands).

Fishery Performance Data
Biological Data
Enforcement Activities and Problems
Plan Administration
Research Results
Problems Requiring Council Consideration and Action
Assess Effectiveness of Monitoring Procedures
Recommended Actions
Appraisal of Impacts of Recommended Actions

This report was prepared using modules submitted by the following agencies: NOAA Fisheries, Southwest Region including its Southwest Fisheries Center Honolulu Laboratory (Honolulu Laboratory) and Office of Law Enforcement; the Territory of American Samoa Department of Marine and Wildlife Resources; the Territory of Guam Division of Aquatic and Wildlife Resources; and the Commonwealth of the Northern Mariana Islands Division of Fish and Wildlife. The modules for American Samoa, Guam and Northern Mariana Islands were prepared using computer programs and graphic procedures prepared cooperatively by the Honolulu Laboratory and the Council (Skillman and Tokunaga 1989; Tokunaga and Skillman 1989a, 1989b).

Fishery statistics included in this annual report are derived from commercial landings information rather than catches obtained from logbooks. Statistics for recreational fishing are not included unless landings enter the market place. In the case of Guam, this second annual report contains some summaries derived from their statistically designed survey of all fishing activities; comparable survey data for American Samoa have not yet been utilized. Also, for first time, catch rate statistics are included in this report. Catch rate for a given species (or species category) and period is defined as the landings of that species in that period divided by the estimated effective number of trips for that period for all PMUS and tunas combined.

SYNOPSIS AND SUMMARY

1. No known foreign longline or purse seine fishing took place in the western Pacific EEZ. This is also the case for domestic purse seine fishing, except possibly in the area of Howland and Baker Islands in 1987 and 1988 (no data made available). Foreign bait-boat fishing for skipjack tuna did take place in the EEZ, but bycatches of PMUS are unknown. Thus, statistics on distant water fishing activities are not available for inclusion in this report.

2. All domestic data included in this report are landings statistics or survey data. None is from logbooks.

3. The landings of PMUS increased in all of the island areas but most appreciably in Guam and the Northern Mariana Islands. The increase in these two areas was due to record mahimahi landings, up two-fold or more from the previous year. Mahimahi landings increased less dramatically in American Samoa and dropped by about 40% in Hawaii. In Hawaii, the two-fold increase in landings of striped marlin resulted in a slight increase in total PMUS landings. Blue marlin landings in Hawaii increased a marginal 8% of those in 1987.

4. Mahimahi compose the largest and most valuable fraction of the PMUS landings in American Samoa, Guam, and Northern Mariana Islands. This result plus data from other North Pacific fisheries and anecdotal information suggest that the mahimahi resource is substantial in the western North Pacific. Landings of wahoo and billfish come in second and third in these fisheries, except in American Samoa where billfish is second. In Hawaii by contrast, striped and blue marlin compose the largest segment of the PMUS landings (in weight), with mahimahi and wahoo coming in third and fourth.

5. To put area landings of PMUS in perspective, Hawaii commercial landings amounted to 4 million pounds having an ex-vessel value of $7 million. Commercial landings in American Samoa, Guam, and Northern Mariana Islands, were 0.01 million pounds ($15,000), 0.1 million pounds ($128,000), and 0.04 million pounds ($48,000), respectively.

6. The landings of PMUS make up the largest component of the commercial fishery in Guam. In Hawaii, PMUS landings rank below tunas but above all others in volume and third after lobster in value. In contrast, the landings of PMUS compose the smallest segment of the fisheries in American Samoa and Northern Mariana Islands.

7. Prices for mahimahi ($2.79-$3.23) and wahoo ($2.69-$2.77) are more than $1/lb. higher in Hawaii than in the other island areas. Also, the prices in Hawaii show an increasing trend whereas in the other areas prices appear stagnant over the long-term and, with inflation, may actually have declined.

8. Estimates of effective fishing effort for American Samoa, Guam, and Northern Mariana Islands, generally increased from 1979 to 1983. Thereafter, there have been no clear fishing effort trends for pelagic fisheries in these areas.

9. The catch rate statistics for American Samoa, Guam, and Northern Mariana Islands are typical of fisheries for highly mobile and seasonally available fishes. That is, they vary annually by factors of two to four and intra-annually by even larger amounts. There is no indication of any sustained decline or increase in catch rates in any of the management areas.

10. Given the size of the landings in the four island management areas, the fishery in Hawaii is the only one large enough to potentially have a significant impact on stock abundance. Events occurring outside the other island fisheries, particularly for Guam and Northern Mariana Islands, are likely to have far greater influence on the stocks than events in the domestic fisheries. [That does not decrease the importance of the statistics from these areas for local development purposes or as a means of monitoring trends in the domestic fisheries or the resources they act upon.]

11. Dramatic changes occurring in the Hawaii tuna longline fishery continued in 1988. The number of boats participating in the fishery reached 50, a 35% increase since 1985. Participation in the fishery is greater during winter when bigeye tuna dominates the catch than during the summer when yellowfin tuna is the dominant species. Conversion from mainlines traditionally made of fiber to ones made of monofilament has also continued. In addition, the transshipment of foreign caught pelagic species to Japan was tried in the fall of 1988. The fish were caught by foreign tuna longline vessels, purportedly just outside the EEZ, and off loaded to domestic vessels for landing in Honolulu.

ASSESSMENT OF MONITORING PROCESS

While our second annual report is more complete than the first, neither as much progress has been made nor have the additions been as substantive as the Team had hoped. The Council's contract programmer, Reese Tokunaga, and Robert A. Skillman from the Honolulu Laboratory have completed the computer programs and graphic procedures for providing some of the basic summaries of commercial fishery statistics going into the report modules for American Samoa, Guam, and Northern Mariana Islands. David C. Hamm and Michael M.C. Quach of the Honolulu Laboratory, Tokunaga, and the island fisheries officers have contributed additional tables and figures. Contained in these tables and charts are summaries of landings, revenue, price, number of vessels, estimates of effective fishing effort (in trips), and catch rate and their trends. These tabulations and charts are descriptive in nature and are based on the fishery "performance data" and "biological data" requirements listed in the FMP.

Catch rate of individual species or species groups is now calculated as landings per effective trip for PMUS and tunas combined as decided upon by the Team. These statistics are used for charting purposes and are saved in files along with the other summary statistics. However, because catch rate was not calculated as landings of a given species divided by the estimated trips having caught just that species, catch rate was not included in the tables to avoid confusion. Because an additional species grouping was needed to compute catch rate and others were included to facilitate investigation of alternative definitions of catch rate, the tables included in this report replace those included in the first annual report.

For Hawaii, data summaries have not been completed in time to include with this draft report. Tokunaga and Skillman have prepared the SAS computer programs for compiling the basic statistics needed; however, the user and system documentation manuals have not been completed. The programs should be released to the State of Hawaii in time for the third annual report.

When the Team began planning for the first annual report, we decided that it would not be possible to include both commercial and survey data within the time available. Thus, Team members decided to work on the commercial data available for all island areas before using the survey data available for Guam and American Samoa. Now that computer programs and graphic procedures have been completed (or nearly so, in the case of Hawaii) to prepare summaries of the commercial data, the Team recognizes that it needs to design summarization procedures for the survey data. Hamm has included some preliminary summaries of the available survey data in the Guam module.

The one remaining major type of biological data not included is size composition. Since the Honolulu Laboratory will be addressing that shortcoming in the second half of 1989, descriptive statistics should be available for the third annual report.

While the pelagic FMP, unlike the bottomfish FMP, does not provide specific criteria to use in evaluating trends or changes in what are called "performance data" and "biological data", the Team recognizes that such criteria should be developed. Now that the basic data on the fisheries are available or will soon be, there is some basis for developing these criteria. The Team plans to devote one multi-day meeting to that purpose in the fall of 1989.

PROBLEMS REQUIRING COUNCIL CONSIDERATION

Section 10.1, Monitoring of the Fisheries, in the FMP lists several items that continue to be of some concern to the Council. The FMP states a need to obtain foreign baitboat and purse seine vessel PMUS by-catch data for fishing operations taking place in the EEZ. While there has been virtually no purse seine fishing, foreign baitboat fishing continues to occur. The Council obtained Japanese baitboat data for 1982-84 via the State Department. The Council recently (21 June 1989) sent a request to the State Department for assistance in obtaining newer data. The FMP states that if data are "not obtained within one year of the effective date of this FMP, the Council shall consider requesting the Secretary of Commerce to promulgate mandatory reporting requirements...."

The large mesh drift gill net fishery directed at tunas and billfishes has a large take of billfishes, particularly striped marlin. Also the drift gill net fishery on squid has a significant incidental take of mahimahi, striped marlin, and swordfish. For these reasons the Council should continue to work with the NMFS in obtaining to seek information on this fishery.

Regarding the domestic tuna longline fishery in Hawaii, the Council recommended in the FMP that the State of Hawaii discontinue use of the Flagline Catch Report and instead use the Fish Catch Report. In addition, the Council recommended modification of the Fish Catch Report to allow for recording of the number of hooks fished and more precise location data. While these recommendations have not been effected, the State is developing a project proposal to review all catch forms and prepare recommended changes.

The growth of the charter boat fishing sector in Guam and Northern Mariana Islands has been substantial and now comprise a significant part of these local fisheries. Thus, the Council may wish to encourage the fisheries offices in these areas to collect data specifically on these fisheries (traditional landings data and socioeconomic data as well) .

The need for fisheries data for non-commercial or industrial scale fisheries continues for Hawaii. Thus, the Council is encouraged to continue participating in the joint project with the State of Hawaii and NOAA Fisheries to field a statistically valid survey to collect these data.

In addition to the above items relating to specific points raised in the FMP, the Team brings the following problems to the Council's attention (not listed by priority). The Governor of Hawaii signed into law a bill relating to drift gill net fishing. This bill appears to prevent the Council from utilizing experimental fishing permits for drift gill net activities (if they should ever want to do so). In addition, it prevents port visitation or, indeed, entry into State waters by any domestic or foreign vessel carrying drift gill nets including, apparently, vessels carrying NOAA Fisheries observers as well as U.S. research vessels.

Data collection under the pelagic FMP depends upon existing state data collection systems. The fishery data systems of American Samoa, Guam, and Northern Mariana Islands have improved substantially since the passage of the Magnuson Fishery Conservation and Management Act and largely meet the monitoring needs appropriate for the size of their fisheries. This situation does not hold for Hawaii. As has been pointed out in the past, statistics for the tuna

longline fishery apparently go largely unreported and significant under-reporting may occur for other fisheries. The unavailability of reasonably complete and accurate statistics renders analyzes of catch, effort, and catch rate statistics and their comparison with statistics derived from other fisheries open to serious challenge. This situation makes it nearly impossible for the Team to monitor the Hawaii pelagic fishery, and this fishery is the major PMUS fishery in the western Pacific EEZ.

Recent developments in the Hawaii tuna longline fishery have raised concern about possible interactions among different segments of the pelagic fishery. Some people now question whether the expansion of the domestic longline fleet and the marked increase in striped marlin catches in 1988 are now having a significant impact on the commercial and sport trolling fishery. Such concern could lead to discussion of allocation among domestic users. Then, the transshipment trial that was conducted in the fall of 1988 raised fears of a foreign fishery developing just outside the EEZ that would intercept pelagic species that would otherwise migrate into the EEZ.

Revised guidelines for national standards 1 and 2 of the Magnuson Act are expected to go into effect in August 1989. These guidelines will require the Council to establish a measurable definition of overfishing for each PMUS covered by the FMP, unless the Council can demonstrate that the FMP is already consistent with the guidelines. Developing such measurable definitions for the highly migratory PMUS will be difficult to impossible given our current state of knowledge of their biology.

With the shifting of U.S. tuna cannery operations and purse seine fishing activities offshore, funding for tuna research has become more difficult to justify. Administrators maintain that the U.S. need not conduct biological research on tuna resources because our involvement in the industry is primarily as marketer and consumer. Whether or not this is true, PMUS research nationally has not benefited since most research on PMUS historically has been a spin off from tuna research. Decision makers need to be made aware of the importance of sport and commercial PMUS fisheries in the western Pacific and, therefore, research on them.

RECOMMENDED ACTIONS

1. To date, trends and changes in the managed pelagic fisheries in the western Pacific EEZ have been evaluated subjectively. Team members estimate a three day workshop will be required to develop quantitative monitoring criteria. These criteria may resemble those developed for bottomfish; however, the highly migratory nature of the PMUS and the lack of information on stock boundaries will require substantially different approaches. Since only three, one day Team meetings have been budgeted, the Team recommends that the Council provide additional funds to hold this workshop.

2. The Team recommends that the Council ask NOAA Fisheries to modify the computer programs and graphic procedures developed for the island annual report modules as necessary to allow use of the quantitative monitoring criteria developed above.

3. The Team recommends that the Council continue to support the development of local capability and ability to collect biological samples and data on size composition as well as analyze the resulting data. That support could be in the form of funded programmatic projects or by facilitating inter-agency cooperation.

4. The Team recommends that the Council request that the Hawaii Division of Aquatic Resources work cooperatively with the Council's various Plan Monitoring Teams to update the format of their fishery data collection instruments.

5. The Team recommends that the Council call for the creation of a task force to decide how to resolve the data collection problem for the pelagic fisheries in the EEZ off Hawaii. The task force could be headed by the Council Chairman (or his designate) and include the NOAA Fisheries Southwest Region Director, the Hawaii Department of Land and Natural Resources Chairman (or his designate) as well as support staff as necessary. Alternative actions may include: specific means of improving the coverage and quality of the State data; the creation of a Federal permit system for at least the major components of the fishery requiring, among other things, that submission of State of Hawaii catch reports for commercial fishing in the EEZ be up to date to either keep or renew the permit; a Federally run statistical survey of fishermen with Federal permits; and a Federal mandatory reporting system.

6. Because the fisheries in American Samoa, Guam, and Northern Mariana Islands are small, availability of statistics from nearby island fisheries may be quite useful for monitoring trends and changes in these fisheries and possibly interactions among them. Thus, the Team recommends that the Council ask the Honolulu Laboratory to make available summaries of fishery statistics available for those areas where their staff have helped set up WPacFIN-like systems. The Team also recommends that the NMFS continue efforts to obtain data on tuna purse seine and longline operations taking place in the western Pacific region.

PLAN ADMINISTRATION AND ENFORCEMENT ACTIVITIES

NOAA Fisheries Southwest Region provided the following summary of plan administration and enforcement activities. Tables providing details of enforcement patrols by the U.S. Coast Guard are on file at the Council as part of the Southwest Region's submission.

I. Administrative Activities

The FMP designates certain areas of the EEZ as retention and non- retention zones for the purpose of regulating the foreign catch of pelagic species; however, no foreign fishing permits were requested by foreign vessels in 1988. Nineteen permits were issued to South Korean longline vessels in 1987, but no requests were received from any of those vessels to enter the exclusive economic zone. The FMP requires foreign longliners that are permitted to fish in the EEZ to file effort plans and to meet specific record keeping and reporting requirements. Observers may be assigned to foreign vessels as needed to enforce and monitor the fishery.

II. Enforcement Activities

In 1988 U.S. Coast Guard C-130 aircraft logged 171.4 hr. of foreign fisheries patrol, covering 38,051 mi. For all of 1988 a total of 26 foreign vessels were sighted. No violations were observed.

Several reports of illegal fishing in the EEZ by foreign longline vessels were received by Guam and Honolulu enforcement offices. Aerial and vessel patrols were conducted by the Coast Guard with negative results. The 14th Coast Guard District created and distributed a system by which domestic fishermen could accurately report suspected or observed fishing violations, which may help enforcement patrols in the future.

Eighteen foreign longliners were boarded and inspected in Honolulu Harbor during 1988.

III. Habitat of the Management Unit Species

At the present time there is no information to suggest that the pelagic habitat of management unit species was subjected to major alterations or modifications in 1988. However, continued introduction of low level pollution sources with occasional pulses of substantial levels is an ongoing problem with unknown impacts on management unit species, particularly at the egg and larval stages. Pollutants impact the pelagic habitat from both point and non-point sources. Pollution sources include run-off from high islands, sewage from deep ocean outfalls and ships at sea, oil from bilges and accidental spills, and marine debris drifting into the western Pacific region or directly introduced into the habitat by vessels.

No known major oil or chemical spills occurred in the western Pacific region FCZ in 1988. A minor spill of approximately 125 barrels of bunker C oil occurred in the FCZ south of Kauai in June 1988. Monitoring from Coast Guard aircraft could detect no major impact to management unit species or other marine life in the area.

On December 31, 1988 regulations went into effect implementing the requirements of the "Marine Plastic Pollution Research and Control Act of 1987". The Act, Title II of Public Law 100-200, became law when it was signed by the President earlier in the year. It was enacted because, as a signatory to the International Convention for the Prevention of Pollution by Ships 1973 and the subsequent Protocol of 1978 (MARPOL), the United States must enforce Annex V of this treaty, entitled "Regulations for the Prevention of Pollution by Garbage by Ships". In summary, by December 31, 1988, it will be unlawful for any vessel to dispose of any plastic article at sea, while other materials cannot be dumped overboard within a range of 3 to 25 miles from land, depending on the material. In addition, adequate disposal facilities will be required to be made available at all ports. This legislation should go a long way toward reducing plastic debris, including fishing net material, in the FCZ of the western Pacific region.

During 1988 the joint Federal-State of Hawaii Task Force established in 1984 continued working on the Final Environmental Impact Statement (EIS), "Proposed Marine Mineral Lease Sale, Exclusive Economic Zone Adjacent to Hawaii and Johnston Island". Potential impacts to management unit species and their habitat, as well as fisheries targeting these species, have been addressed in the EIS. The release of the Final EIS is scheduled for late 1989.

RESEARCH RESULTS

The following reports on research results were provided by the agency indicated.

I. NOAA FISHERIES

1. Using hook-timers and depth recorders to investigate vertical distribution of tropical pelagic fishes. Christofer H. Boggs

Differences in tuna and billfish hooking rates by deep and shallow longline fishing gear (Hanamoto 1976, Suzuki et al. 1977) are important factors in stock assessments based on longline catch and effort statistics (Suzuki 1989). Both longline hook rate studies and sonic tracking data indicate that yellowfin tuna (Thunnus albacares) and billfishes prefer shallower, warmer habitats than bigeye tuna (T. obesus). Habitat depths appear to differ by area (Hanamoto 1987) and season, in response to variations in the thermocline and oxycline. Hook-timers and time-depth recorders increase the power of longline fishing gear as a tool for investigating pelagic fish habitats and vulnerability to fishing gear.

In longline fishing, baited hooks pass through the water column as they sink to a variety of depths and are pulled out many hours later. Thus, researchers do not usually know when a fish bites or the depth at which the fish was caught. Hook-timers recently invented by Honolulu Laboratory scientists for bottom fish studies are designed to indicate when each hook catches a fish. A digital clock is triggered when a fish strikes the hook, measuring the time elapsed until the fish is landed. Combined with time-depth recordings of the position of the gear, the actual depth of capture for each fish can be estimated.

In most longline studies, the maximum depth that each hook attains during fishing is approximated from equations for standard gear configurations based on a few observations from echo sounders or depth recorders. In a longline research cruise aboard the NOAA ship Townsend Cromwell last January, light-weight, microprocessor-controlled time-depth recorders were used to make continuous measurements of gear depth. The longline was constructed of heavy gauge monofilament nylon, which is becoming popular in Hawaii's rapidly expanding commercial tuna longline fishery. The fishing depth of this gear is more flexible than traditional rope gear. Hook depths can be controlled by using a line thrower to deploy the line faster than the speed of the vessel by a varying amount.

As a shakedown trip, the research cruise was highly successful. Catch per hook values were comparable to those of commercial fishermen fishing in the same area. Newly fabricated hook-timers suffered a very low rate of electronic failure. A basic hypothesis--that bigeye tuna could be targeted and the by-catch of billfish reduced by increasing the depth of longline sets--was supported by the results. However, an initially high rate of time-depth recorder failure forced a limited use of these instruments, and hook-timer trigger mechanisms functioned variably, so that those results were compromised. A second longline cruise is planned for January 1990.

A total of 16 longline sets were made on the first cruise, averaging 270 hooks per set (range, 128-474), for a combined catch of 149 fish. The sets were categorized on the basis of maximum depth into three strata: 71-208 m (shallow), 274-342 m (deep), and 391-446 m (deepest)--each representing equivalent amounts of fishing effort. Billfish catches (mostly striped marlin, Tetrapturus audax, and shortbill spearfish, T. angustirostris) were twice as high in shallow sets as they were in the deep and deepest sets. Conversely, tuna catch rates (mostly bigeye tuna) nearly doubled between shallow and deep sets and nearly doubled again between the deep and deepest sets.

Achieving deep sets was difficult. Fast shooter speeds caused backlash that jammed the shooter if the drag on the reel was not correctly adjusted. This adjustment requires changing as the reel unwinds in commercial operations involving 20-50 mi of mainline. During the research cruise, the line shooter read-out indicated speeds much faster than actual speeds, and vessel speed through the water was typically faster than the speed estimated by the ship's officers. This reduced the slack needed for deep sets. Even taking these factors into account, sets were often only half as deep as expected, because of effects of current and wind.

In Hawaii, concern has been expressed over the impact of expanding domestic and foreign longline fisheries on recreational fisheries. The results of this study indicate that any such impact of longline fishing on billfish stocks could be mitigated by increasing expertise of commercial fishermen in achieving deep sets.

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Suzuki, Z., Y. Warashina, and M. Kishida. 1977. The comparison of catches by regular and deep tuna longline gears in the Western and Central Equatorial Pacific. Bull. of the Far Seas Fish. Res. Lab. 15:51-83.

Suzuki, Z. 1989. Assessing the status of Pacific marlin stocks. Proceedings of the Second International Billfish Symposium, in press.

2. Pacific international billfish angler survey. James L. Squire

The Pacific International Billfish Angler Survey, which started in 1969, annually collects information on billfish angler catch rates in the Pacific and Indian Oceans. This is the 19th year of the Survey. Results of the previous year's Survey, determined from the responses from billfish anglers, are updated in each issue of the Billfish Newsletter.

Results - 1987 Survey

In 1987, the total number of billfish fishing days (or angler days) reported by those anglers responding to the Survey was 14,847. Of this number, 13,722 angler days were reported for the Pacific Ocean (and Indo-Pacific), and 708 angler days reported for the Indian Ocean. The remaining angler days, 417, were reported by

anglers fishing in the Gulf of Mexico, Caribbean Sea or Atlantic Ocean.

Anglers responding to the Survey reported catching 6,625 billfish in the Pacific Ocean and 364 billfish in the Indian Ocean, for a total of 6,989 billfish. Species breakdown for the Pacific Ocean catch was 997 blue marlin, 368 black marlin, 3,460 striped marlin, and 1,800 sailfish. For the Indian Ocean, it was 17 blue marlin, 8 black marlin, 26 striped marlin, and 313 sailfish. The catch rate for the Pacific Ocean was 0.48 fish per day or 2.1 days per fish. For the Indian Ocean, the rate was 0.51 fish per day or 1.94 days per fish. These catch rates are lower than those reported in 1986, 0.51 for the Pacific, and 0.66 for the Indian Ocean.

The Pacific Ocean angler catch rate for 1987 is 13% below that determined for the 1969-1972 period (0.55 fish per day).

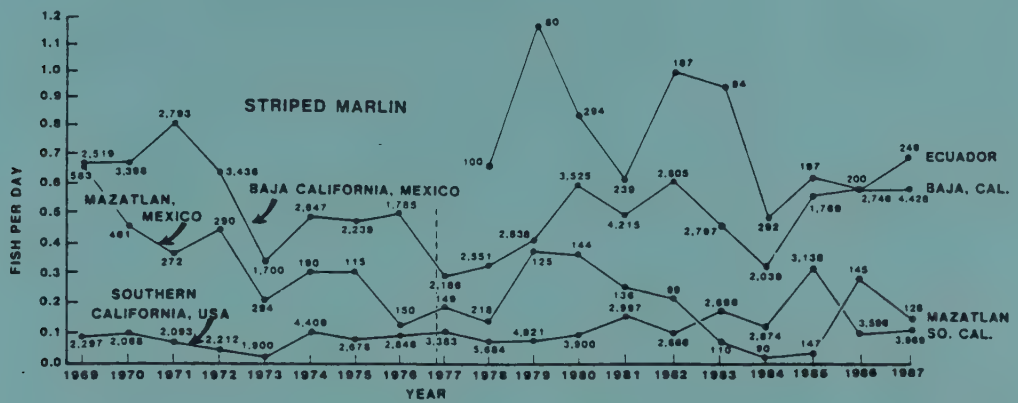

Figure 4. CPUE (number of fish/angler day) for striped marlin and number of angler days reported fishing in important catch areas, 1969-1987.

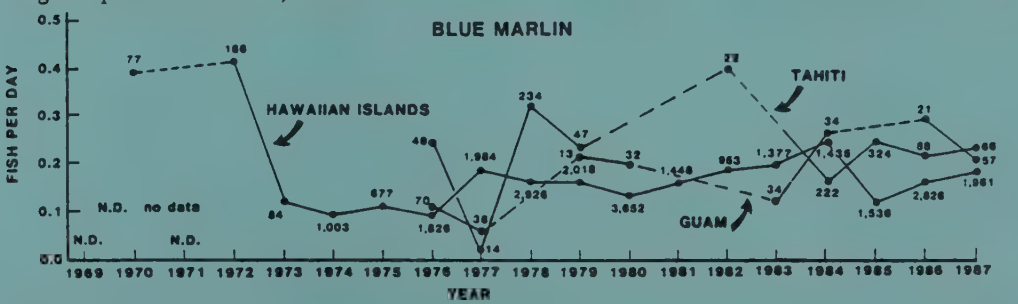

Figure 5. CPUE (number of fish/angler day) for blue marlin and number of angler days reported fishing in important catch areas, 1969-1987.

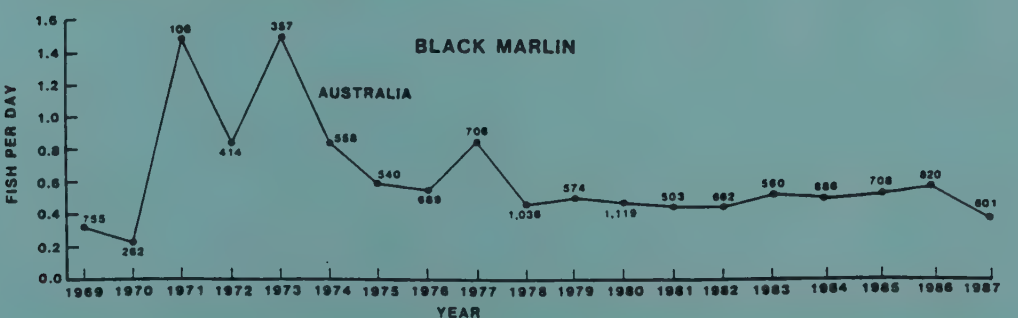

Figure 6. CPUE (number of fish/angler day) for black marlin and number of angler days reported for fishing in important catch areas, 1969-1987.

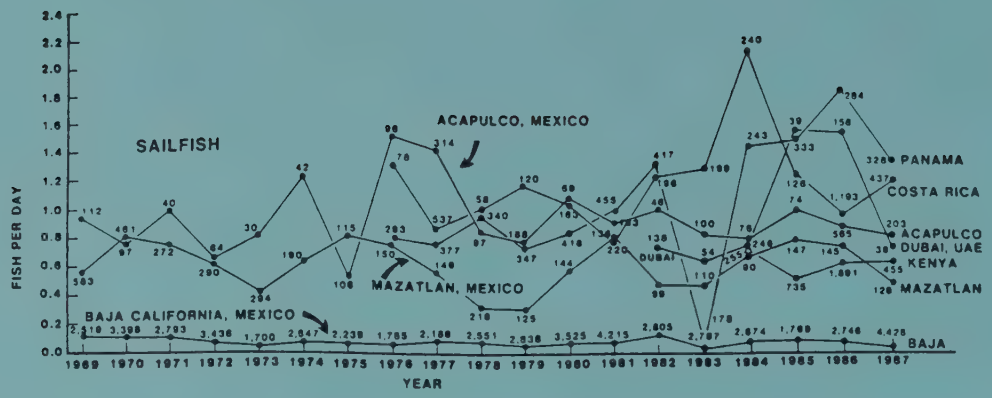

Figure 7. CPUE (number of fish/angler day) for sailfish and number of angler days reported for fishing in important catch areas, 1969-1987.

Graphics showing CPUE (catch per angler day) data are given for some fishing areas, for striped marlin (Figure 4), blue marlin (Figure 5), black marlin (Figure 6), and sailfish (Figure 7).

Table 1. Results of 1987 Billfish Angler Survey - More than 100 angler days reported.

	Angler Fishing Days	No. of Billfish	Billfish/ Fishing Day	Fishing Days/ Billfish	Major Species[1]
Pacific Ocean					
Baja California, Mexico (tip area)	4,428 (2,746)	3,236 (2,022)	0.73 (0.74)	1.3 (1.3)	SM (SM)
Southern California, U.S.A.	3,969 (3,596)	499 (401)	0.12 (0.11)	7.9 (8.9)	SM (SM)
Hawaii, U.S.A.	1,961 (2,826)	492 (836)	0.25 (0.30)	3.9 (3.2)	BLM (BLM)
Australia	601 (820)	314 (615)	0.52 (0.75)	1.9 (1.3)	BKLM (BKLM)
New Zealand	560 (532)	34 (35)	0.06 (0.07)	15.2 (15.2)	SM (SM)
Costa Rica	437 (1,193)	577 (1,268)	1.32 (1.06)	0.7 (0.9)	SF (SF)
Panama	328 (284)	597 (588)	1.82 (2.07)	0.5 (0.4)	SF (SF)
Ecuador	249 (200)	225 (160)	0.90 (0.80)	1.1 (1.2)	SM (SM)
Acapulco, Mexico	203 (565)	189 (506)	0.93 (0.90)	1.1 (1.1)	SF (SF)
Mazatlan, Mexico	128 (145)	110 (137)	0.86 (0.94)	1.2 (1.1)	SF (SF)
Guaymas/Kino, Mexico	119 (124)	14 (11)	0.11 (0.09)	8.5 (11.2)	SF (SF)
Guatemala	116 (21)	148 (9)	1.27 (0.43)	0.8 (2.3)	SF (SF)
Manzanillo, Mexico	107 -	58 -	0.54 -	1.8 -	SF -
Indian Ocean					
Kenya	456 (1,891)	317 (1,194)	0.69 (0.63)	1.4 (1.6)	SF (SF)

[1]SM–Striped Marlin; BKLM– Black Marlin; BLM– Blue Marlin; SF– Sailfish

Tables 1 and 2 give the results of the 1987 survey submitted by anglers, by landing locations in the Pacific and Indian Oceans. The tables include location, number of angler days reported, number of billfish reported caught, CPUE in terms of fish/day and days/fish, for locations having over 100 angler days reported, major species reported for area, and number of angler days and catch for areas reporting less than 100 angler days. Information on 1986 data is given in parenthesis (-) for comparison, for areas having over 100 anger days reported. (J. Squire, FTS 893- 7072)

Table 2. Results of 1987 Billfish Angler Survey - Less than 100 angler days reported

	Angler Fishing Days	# of Billfish	Major Species[1]
Pacific Ocean			
Thailand	72	120	SF
Tahiti	66	19	BLM
Guam	57	19	BLM
Papua New Guinea	51	4	BKLM
Peru	45	16	SM
Fiji	38	3	BLM
Japan	28	6	BLM
San Blas, Mexico	25	6	SF
Malaysia	25	5	BKLM
Caroline Islands	17	2	BLM/SF
Chile	12	0	
Christmas Island	9	2	SF
Colombia	8	7	SF
Puerto Vallarta, Mexico	7	5	BKLM
Revillagigedo Island, Mexico	5	1	BKLM
Samoa	4	4	SM
Nicaragua	3	4	SF
Indian Ocean			
Mauritius	76	14	BLM
Arabian Gulf (Dubai)	39	28	SF
Maldive Islands	24	4	BKLM
Somalia	20	1	SF
South Africa	9	1	SF

[1]SM– Striped Marlin; BKLM– Black Marlin: BLM– Blue Marlin; SF– Sailfish

3. Pacific billfish angler catch rates for key area stock assessments. James L. Squire. Marine Fisheries Review 49(2): 15-25.

ABSTRACT--The Pacific Billfish Angler Survey was initiated in 1969 to measure the trend of angler CPUE annually. Survey respondents (1969-84) have reported 145,661 angler days catching 59,460 billfish, resulting in an average CPUE of 0.41 fish/day or 2.45 days of fishing per billfish. Annual totals of catch, effort, and resulting CPUE are given for many of the important recreational billfish fishing areas. A comparison of CPUE trends between the commercial longline and the recreational angler is made for the area about the southern tip of Baja California where high CPUE rates are common to both fisheries. The correlation between recreational and commercial CPUE is reasonable ($Y_2 = 0.82$), and the recreational angler CPUE is negatively affected by the nearby commercial longline fishery.

4. Striped marlin, Tetrapturus audax, migration patterns and rates in the northeast Pacific Ocean as determined by a cooperative tagging program: its relation to resource management. James L. Squire. 1987. Marine Fisheries Review 49(2): 26-43.

ABSTRACT--Migration patterns and rates for striped marlin, Tetrapturus audax, tagged and recaptured in the northeast Pacific Ocean during 1957-81 are reported by time period and analyzed. Few long-range migrations and no trans-Pacific migrations were observed. Comparisons are made with other types of physical and biological data that might indicate seasonal movement (i.e., longline catch rates, areas of striped marlin spawning, movement of thermocline depth relative to fishing success). A tentative hypothesis describing the seasonal movement of striped marlin in the northeast Pacific and the total eastern Pacific is also proposed and presented in graphic form.

5. Western Pacific Pelagic Fisheries in 1988. Samuel G. Pooley. 1989. SWFC Admin. Rep. H-89-11 (Appendix IV of this report)

II. WAIKIKI AQUARIUM

Research on mahimahi culture Syd Kraul. 10 MAY 1989.

Our research to improve mahimahi culture methods had useful results this year. We can attain up to 45% survival to day 30 (weaned to nonliving foods), and over 10% to day 60 ("totally safe" for stocking in grow-out vessels, or tagging and releasing). Our excess fourth and fifth generation (F4 and F5) broodstock, juveniles and eggs were transferred to Anuenue Fisheries Research Center for tagging and grow-out trials, Oceanic Institute for larval rearing tests, Hawaii Institute of Marine Biology for physiology research, Queen Liliuokalani Children's Center for social programs and to have an egg supply in Kailua-Kona, and Waikiki Aquarium (for mahimahi display tests. The F6 generation is now being used for diet and grow-out tests. They will reach spawning age 15 September 1989.

Normal mahimahi gut flora and (LD50) resistance to bacterial infection were analyzed by our University of Hawaii graduate assistant, Carl Arume. Professor Harry Ako, University of Hawaii Agricultural Biochemistry Department, studied mahimahi nutrition, and tested several feeds at the Aquarium. Professor Rebecca Cann and University of Hawaii graduate student Chris Herzig in the Genetics

Department tested methods to detect variation in mitochondrial DNA in mahimahi. So far, they have shown that Hawaiian mahimahi differ from Taiwan mahimahi. We hope to find a genetic tag in our thoroughbred stock, so we can measure stock enhancement effects of mahimahi released by the Anuenue Center. We also hope to discover migration and population structure patterns, if any, for mahimahi throughout the world.

Mahimahi aquaculture now appears to have potential for profit. Large commercial aquaculture companies are negotiating for culture sites, or readying corporate funds to develop sites in Hawaii.

We are just finishing our biennial (June 1, 1987-May 31, 1989) grant project, titled "Mass Culture Methods for the Mahimahi." We have been funded by the same agencies, (Sea Grant and Hawaii's Aquaculture Development Program, with a special legislative supplement from Senator Richard Matsuura) to continue mahimahi research in a project titled "Mahimahi Pathology, Nutrition, and Genetics."

Recent papers published as a result of our research include:

Kraul, S. 1989. Review and current status of the aquaculture potential for the mahimahi, Coryphaena hippurus. Proceedings of the Advances in Tropical Aquaculture Workshop, Tahiti, February, 1989.

Kraul, S. 1989. Production of live prey for marine fish larvae. Proceeding of the Advances in Tropical Aquaculture Workshop, Tahiti, February, 1989.

Kraul, S. In review. Hatchery methods for the mahimahi, Coryphaena hippurus, at Waikiki Aquarium. In: CRC Handbook of Mariculture, Vol. II: Finfish.

Kraul, S, A. Nelson, K. Brittain, and D. Wenzel. 1989. Feeding and handling requirements for hatchery culture of the mahimahi, Coryphaena hippurus. Sea Grant Quarterly 10(3): 6 p.

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Tokunaga, R. and R.A. Skillman. 1989. User's manual for the sales and revenue report preparation system using commercial landings data. III. Northern Mariana Islands Edition. Southwest Fisheries Center Software Documentation 89-04-H: 27p.

AMERICAN SAMOA FISHERY MODULE

ANNUAL REPORT FOR THE 1988 PELAGIC FISHERIES OF THE TERRITORY OF AMERICAN SAMOA

JUNE 1989

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Western Pacific Regional Fishery Management Council's

PELAGIC PLAN MONITORING TEAM

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American Samoa Commercial Pelagic Fishery

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INTRODUCTION

The Fishery Management Plan (FMP) for the Pelagic Fisheries of the Western Pacific Region was implemented by the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA Fisheries) in 1987. The Western Pacific Regional Fishery Management Council (Council) developed the FMP to manage the pelagic resources occurring in its area of jurisdiction as defined in the Magnuson Fishery Management and Conservation Act of 1976. The management goal of the Pelagic FMP is to maintain pelagic stocks at optimal population levels while managing foreign fishing; promoting equitable domestic utilization of the resources by commercial, subsistence, and recreational sectors; eliminating waste from incidental harvest; and diminishing the risk of gear conflicts.

The pelagic management unit species (PMUS) covered by this FMP are given below.

Common Name	Scientific Name
Mahimahi (dolphinfish)	Coryphaena hippurus
Pompano dolphinfish	C. equiselis
Wahoo	Acanthocybium solandri
Indo-Pacific blue marlin	Makaira mazara
Black marlin	M. indica
Striped marlin	Tetrapturus audax
Shortbill spearfish	T. angustirostris
Swordfish	Xiphias gladius
Requiem sharks	Carcharhinidae
Thresher sharks	Alopiidae
Hammerhead sharks	Sphyrnidae
Mackerel sharks	Lamnidae

The Pelagic FMP required the Council to establish a Pelagic Plan Monitoring Team (Team) to prepare an annual report on the status of the pelagic fisheries for each of the island areas served by the Council. The Team decided to adopt a modular approach to developing the annual report, whereby each island area would develop an individual report for its pelagic fishery and would submit the report to the Team for review. This report module is submitted to the Team on behalf of the Territory of American Samoa Department of Marine and Wildlife Resources (DMWR) to help the Team determine the effectiveness of the FMP in meeting its goal in American Samoa.

Preparation of this report was a cooperative effort among staff of the NOAA Fisheries Honolulu Laboratory's Western Pacific Fishery Information Network (WPACFIN), a contractor of the Council, and a newly appointed Team member from DMWR. Some of the tables and figures were prepared by the contractor using computer programs developed specifically for the Council for that purpose; other data summaries, tables, and figures were prepared by WPACFIN staff using ad-hoc programs and data base queries. All data used in this report were collected by DMWR staff. The

DMWR is upgrading its computer processing capabilities to enable its Team member to complete all processing for writing future reports. The WPACFIN is assisting DMWR meet this goal. This annual report module on the pelagic fisheries of American Samoa was prepared through cooperative efforts of the agencies involved and is the official submission of the DMWR to the Team for the 1988 calendar year.

FISHERY PERFORMANCE DATA

The American Samoa fishery operates primarily around the main island of Tutuila and the Manu'a Islands and is carried out primarily from small (about 28-foot) catamarans, called alias, and manta cats making 1 to 2-day trips. The DMWR staff obtained data from 1982 to September 1985 by attempting to interview each boat operator at dockside at the time of landing; however, a complete enumeration of each landing was not obtained. The fisheries staff enumerated the number of trips taken by each commercial vessel and used each vessel's average landings per trip to estimate total annual harvest for each vessel. The sum of the estimated landings for all vessels was then divided by the sum of all documented landings to create an expansion factor for estimating total catch by species. These expansion factors were used to raise the tabulated amounts by simple, direct proportion. Starting in October 1985, data were collected using a survey design employing sampling and statistically based expansion algorithms for the Tutuila fishery and by continuing the enumeration for the Manu'a fishery. Therefore, data presented in this report are estimates of the commercial landings of pelagic species in American Samoa.

Fishery performance data are summarized in Tables 1-8 and Figures 1-18 in Appendices A and B, respectively. Although tuna species are not covered by the FMP, they are included in various tables and figures because they are, by far, the most important pelagic fishery resource harvested in American Samoa. The commercial harvest of shark species is very low. Annual summaries for years prior to 1988 have been included in this report because species subtotals not provided in the first annual report have been added to the tables. For brevity, tables of monthly statistics are not included in this report, but they are available for review at the Honolulu Laboratory. Monthly data are presented in many of the figures. Comments on the data summarized in the tables and figures are provided under the following subsections as identified in the FMP. For additional background information on American Samoa's data collecting systems, assumptions and analyses used to summarize data in this report, the pelagic fishery, or specifics on other American Samoa fisheries, refer to the Team's other annual report, volumes of WPACFIN's "Fishery Statistics of the Western Pacific" (Hamm and Kassman 1986, Hamm and Quach 1988, 1989), or Aitaoto (1989).

1. Total Catch, Foreign and Domestic, by Species and Gear

No licensed foreign fishing under the FMP has taken place since the plan came into effect; hence, there are no foreign data to summarize. Total domestic "catch" data are not available, only estimated "landings," which are reported below.

2. Total Landings and Estimated Revenues by Species and Gear

Estimated domestic commercial landings of pelagic species in 1988 equaled 180,860 pounds--up from the 1987 landings but still lower than the peak of 1984 (Figure 1). The value of the landings was $158,359, which was more than the 1984 landings but less than the 1986 landings (Figure 1). The 1988 landings of PMUS were also up from 1987, but only slightly (Figure 2). Tunas remain the primary pelagic group landed, followed by the "all others" category, which is predominantly bottomfish and reef fish (Figure 2). The principal method used to harvest pelagics is trolling (Figure 3). Although the landings of mahimahi, billfish, and sharks increased in 1988, landings of wahoo declined (Figure 4).

3. Fishing Effort

Fishing effort was estimated in terms of the effective number of trips in which each pelagic species or species group was landed. An effective trip for a particular species (or species category) is defined as a fishing trip resulting in the landing of said species (or species category). The total number of effective pelagic trips decreased slightly in 1988 (Figure 1) because of a decrease in the number of effective trips for tunas (Figure 5). However, the number of effective trips for the PMUS group increased in 1988 (Figure 5) as did the number of effective trips for all species within the PMUS group (Figure 6). Trolling was the most important method used in 1988, but the longline method was reported for the first time since 1985 (Figure 7).

4. Annual and Quarterly Catch Rate by Species and Gear

Catch rate is calculated by dividing the landed weight of a species (or species category) by the number of trips resulting in a landing of any of the pelagic species, including tunas. Quarterly catch rates are not provided; however, annual, monthly, and average monthly catch rates for the trolling-surface method are summarized in Figures 8, 9-11, and 12, respectively. The annual catch rate of sharks rose from zero in 1987, and that of mahimahi and billfish increased sharply in 1988, whereas the annual catch rate of wahoo decreased. This seems somewhat at odds with the fact that wahoo showed an increase in the number of effective trips in 1988. Catch rates were highest during the peak seasons for each species.

5. Relationships Among Fishery Sectors

5.1 Species Categories

Annual landings of PMUS are relatively low and exceed only those of the miscellaneous pelagics category (Figure 2). In contrast, annual landings of tuna and the all others category are substantially higher. On average, species category rankings are tunas, all others (primarily bottomfish and reef fish), PMUS, and miscellaneous pelagics. Ranking within the PMUS group are mahimahi, billfish, wahoo, and sharks (Figure 4).

5.2 Fishing Methods

Fishing method is recorded for most trips taken, and surface trolling is the only method used in American Samoa to harvest significant quantities of PMUS. The troll-bottom method is actually not a different type of trolling method and, instead is a different type of fishing trip, that is, a single trip in which both trolling and bottom fishing were done. A small amount of tuna longlining also was recorded during 1988.

5.3 Fishery Stability

A total of 115 fishermen (boats) have landed pelagic species commercially since 1982. Figure 13 shows the annual growth of the fishery from 1982 to its peak in 1986, then a sharp decline in 1987 and an increase in 1988. A statistic often used in describing and monitoring a fishery is the number of the most productive fishermen in a fishery, or "highliners." Highliners is herein defined as the number of sampled fishermen landing over 3,000 pounds of pelagic species annually. The number of highliners has fluctuated over the years, but has been fairly stable in terms of the percentage of total pelagic fishes landed by these major fishermen. Since 1984, there has been an average of 43 fishermen, with the top 8 responsible for about 60% of the sampled pelagic commercial landings.

6. Species Composition

On average, the rank of species contributing to the landings of PMUS is mahimahi, billfish, wahoo, and sharks (Figure 4). While annual mahimahi landings generally exceed those of billfish, landings of billfish can be relatively substantial, as in 1988. Wahoo landings have declined for the past 2 years, while shark landings are quite low. Species composition seems to be fairly stable in the fishery, although no statistical analyses have been performed on the data to verify this statement.

7. Trends

7.1 Landings

No obvious significant difference in the trend of the pelagic fishery has occurred since the last annual report, although statistical methods have not been applied to the data.

The 1988 mahimahi, billfish, and shark landings increased, while the wahoo landings declined for the second year in a row.

7.2 Fishing Effort

Annual effective fishing effort (trips) for the PMUS group, the PMUS species caught by surface trolling, and the PMUS group by fishing method are plotted in Figures 5, 6, and 7, respectively. No long-term trends are obvious; however, no statistical analyses have been performed.

7.3 Catch Rate

Annual catch rates of the PMUS caught by surface trolling show no discernible trends (Figure 8). Long-term monthly and average monthly catch rates are provided for the PMUS caught by surface trolling (Figures 9-12) and show higher catch rates for each species during their highest seasonal abundance. No trends are obvious, but no statistical analyses have been performed on the data.

8. Seasonal Patterns of Fishing

Visual interpretations of average monthly landings and long-term monthly landings of the PMUS (Figures 14-18) indicate a broad June to October mahimahi season; a distinct January-February billfish season with smaller spikes in May, June, and November; and no discernible seasonality for wahoo and sharks. Adjusting for the "reverse" Southern Hemisphere seasons of American Samoa, makes the seasonal peaks of the PMUS similar to those in other management areas, e.g., winter-spring mahimahi and summer billfish seasons.

9. Size Composition

Size composition statistics were not available for 1988.

ENFORCEMENT ACTIVITIES, PLAN ADMINISTRATION, AND PROBLEMS

This section should be added by the NMFS Enforcement branch and the U.S. Coast Guard.

RESEARCH RESULTS

The DMWR has been conducting fishing experiments around Fish Aggregation Devices (FAD's), but those data are not available to include in this report. A FAD project report is being prepared. Biological data on stomach contents of tunas have been collected by DMWR during the last 2 years. Analysis of this information will begin as soon as funds are available.

PROBLEMS REQUIRING COUNCIL CONSIDERATION AND ACTION

The fishery seems stable and growing, and DMWR staff identified no problems requiring Council action.

ASSESSMENT OF MONITORING PROCESS

Existing computer programs for summarizing and analyzing available data are insufficient to properly monitor the resource and describe the fishery. Assistance is needed to develop these tools to be used by the DMWR Team member in preparation of subsequent annual reports.

RECOMMENDED ACTIONS

To date, only visual interpretations have been used on the data. More thorough and statistically valid analyses should be performed on the data to determine whether trends or problems actually exist in this fishery. The Team should identify specific questions about the fishery; form hypotheses to answer these questions; determine analytical methods to test these hypotheses; provide guidelines for interpreting the analyses; and determine what constitutes trends, changes, or problems in the fishery. The team should develop specific recommendations for format and content of the annual report modules. A special 2- to 5-day workshop should be held, possibly in concert with the Bottomfish Team and select members of the Council's Scientific and Statistical Committee, to resolve these problems for all Council management areas.

The DMWR collects hours-fished information for all interviews obtained. Effort analyses should not be limited to catch-by-trip analyses, but should also use catch-per-hour information to obtain more precise measurements of fishing effort. Computer programs need to be written and transferred to DMWR to provide these statistics.

Length-frequency sampling should be implemented to monitor the major pelagic species.

The Team should discuss and decide whether it is useful and beneficial to treat fishing trips which only trolled and those which trolled and bottomfished as two separate fishing methods for pelagics for all summaries and analyses.

Existing computer programs written under contract to the Council should be transferred to DMWR, with appropriate training, to enable DMWR's Team member to prepare next year's module. Many other computer programs need to be written and transferred to DMWR to provide information and statistical analyses that are not included in the contractor's current processing system.

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APPENDIX A: TABLES

Table 1

Summary of the American Samoa Commercial Pelagic Fishery, 1982-88

		1982	1983	1984	1985	1986	1987	1988
Number of fishermen (boats) landing pelagics		18	24	40	46	54	34	41
Number of trips which landed pelagics		221	413	667	525	1131	661	644
*Number of fishermen (boats) landing over 3,000 pounds of pelagics in the year		2	3	12	9	8	4	6
*Percent of total pelagics landed, that were landed by fishermen with over 3,000 pounds for the year		55	53	78	75	51	56	57
Total estimated commercial landings of pelagic species (including tunas)	Pounds	24818	90743	236213	130665	190067	138274	180860
	Dollars	21826	66259	153568	130583	166617	116810	158359

* Based on data base sample data, not a census of the commercial fishery.

Table 2

AMERICAN SAMOA 1982 ANNUAL ESTIMATED
COMMERCIAL LANDINGS OF PELAGIC SPECIES
DEPARTMENT OF MARINE AND WILDLIFE RESOURCES

EFFORT, SALES, AND REVENUE
BY METHOD AND SPECIES

FISHING METHOD	SPECIES	NUMBER TRIPS	WEIGHT (LBS)	REVENUE ($)	PRICE ($/LB)
TROLLING-SURFACE	PMUS TOTAL	18	1298	1243	0.96
	MAHIMAHI	17	742	742	1.00
	WAHOO	4	114	103	0.90
	BILLFISH TOTAL	2	442	398	0.90
	BLUE MARLIN	1	315	284	0.90
	SAILFISH	1	127	114	0.90
	TUNAS TOTAL	175	21724	18695	0.86
	PMUS & TUNAS	176	23022	19938	0.87
	PELAGICS-MISC. TOTAL	13	833	685	0.82
	RAINBOW RUNNER	4	20	35	1.75
	MISC. TROLL FISH	10	813	650	0.80
	ALL PELAGICS	183	23855	20623	0.86
BOTTOMFISH	PMUS TOTAL	3	14	25	1.74
	SHARKS	3	14	25	1.74
	TUNAS TOTAL	8	510	509	1.00
	PMUS & TUNAS	11	524	534	1.02
	PELAGICS-MISC. TOTAL	28	408	615	1.51
	RAINBOW RUNNER	1	4	7	1.75
	MISC. TROLL FISH	28	404	608	1.51
	ALL PELAGICS	39	932	1149	1.23
SPEAR	PMUS TOTAL	1	31	54	1.75
	SHARKS	1	31	54	1.75
	PMUS & TUNAS	1	31	54	1.75
	ALL PELAGICS	1	31	54	1.75
ALL GEARS	PMUS TOTAL	22	1343	1322	0.98
	MAHIMAHI	17	742	742	1.00
	WAHOO	4	114	103	0.90
	BILLFISH TOTAL	2	442	398	0.90
	BLUE MARLIN	1	315	284	0.90
	SAILFISH	1	127	114	0.90
	SHARKS	4	45	79	1.75
	TUNAS TOTAL	182	22234	19204	0.86
	PMUS & TUNAS	188	23577	20526	0.87
	PELAGICS-MISC. TOTAL	41	1241	1300	1.05
	RAINBOW RUNNER	5	24	42	1.75
	MISC. TROLL FISH	38	1217	1258	1.03
	ALL PELAGICS	221	24818	21826	0.88

Table 3

AMERICAN SAMOA 1983 ANNUAL ESTIMATED
COMMERCIAL LANDINGS OF PELAGIC SPECIES
DEPARTMENT OF MARINE AND WILDLIFE RESOURCES

EFFORT, SALES, AND REVENUE
BY METHOD AND SPECIES

FISHING METHOD	SPECIES	NUMBER TRIPS	WEIGHT (LBS)	REVENUE ($)	PRICE ($/LB)
TROLLING-SURFACE	PMUS TOTAL	46	3150	3950	1.25
	MAHIMAHI	39	1443	2216	1.54
	WAHOO	13	550	800	1.45
	BILLFISH TOTAL	4	1157	934	0.81
	BLUE MARLIN	2	1083	867	0.80
	SAILFISH	2	74	67	0.90
	TUNAS TOTAL	350	70693	49238	0.70
	PMUS & TUNAS	357	73843	53188	0.72
	PELAGICS-MISC. TOTAL	39	842	1184	1.41
	RAINBOW RUNNER	24	654	877	1.34
	MISC. TROLL FISH	20	188	307	1.64
	ALL PELAGICS	359	74685	54372	0.73
LONGLINE-TUNA	TUNAS TOTAL	4	15056	10254	0.68
	PMUS & TUNAS	4	15056	10254	0.68
	ALL PELAGICS	4	15056	10254	0.68
BOTTOMFISH	PMUS TOTAL	11	374	633	1.69
	WAHOO	2	81	122	1.50
	SHARKS	9	293	511	1.74
	TUNAS TOTAL	11	237	318	1.34
	PMUS & TUNAS	22	611	951	1.55
	PELAGICS-MISC. TOTAL	26	243	422	1.74
	MISC. TROLL FISH	26	243	422	1.74
	ALL PELAGICS	44	854	1373	1.61
SPEAR	PELAGICS-MISC. TOTAL	6	35	62	1.75
	MISC. TROLL FISH	6	35	62	1.75
	ALL PELAGICS	6	35	62	1.75
GILL NET-7/10 FT	PELAGICS-MISC. TOTAL	13	113	198	1.75
	MISC. TROLL FISH	13	113	198	1.75
	ALL PELAGICS	13	113	198	1.75

Table 3 (Cont.)

FISHING METHOD	SPECIES	NUMBER TRIPS	WEIGHT (LBS)	REVENUE ($)	PRICE ($/LB)
ALL GEARS	PMUS TOTAL	56	3524	4583	1.30
	MAHIMAHI	39	1443	2216	1.54
	WAHOO	15	631	922	1.46
	BILLFISH TOTAL	4	1157	934	0.81
	BLUE MARLIN	2	1083	867	0.80
	SAILFISH	2	74	67	0.90
	SHARKS	9	293	511	1.74
	TUNAS TOTAL	361	85986	59810	0.70
	PMUS & TUNAS	374	89510	64393	0.72
	PELAGICS-MISC. TOTAL	81	1233	1866	1.51
	RAINBOW RUNNER	24	654	877	1.34
	MISC. TROLL FISH	63	579	989	1.71
	ALL PELAGICS	413	90743	66259	0.73

Table 4

AMERICAN SAMOA 1984 ANNUAL ESTIMATED
COMMERCIAL LANDINGS OF PELAGIC SPECIES
DEPARTMENT OF MARINE AND WILDLIFE RESOURCES

EFFORT, SALES, AND REVENUE
BY METHOD AND SPECIES

FISHING METHOD	SPECIES	NUMBER TRIPS	WEIGHT (LBS)	REVENUE ($)	PRICE ($/LB)
TROLLING-SURFACE	PMUS TOTAL	70	6432	5205	0.81
	MAHIMAHI	47	1446	1693	1.17
	WAHOO	26	631	730	1.16
	BILLFISH TOTAL	17	4355	2782	0.64
	BLUE MARLIN	14	4158	2604	0.63
	SAILFISH	3	197	178	0.90
	TUNAS TOTAL	463	155017	89590	0.58
	PMUS & TUNAS	474	161449	94795	0.59
	PELAGICS-MISC. TOTAL	180	23371	19402	0.83
	RAINBOW RUNNER	72	2111	2179	1.03
	MISC. TROLL FISH	124	21260	17223	0.81
	ALL PELAGICS	567	184820	114197	0.62
LONGLINE-TUNA	PMUS TOTAL	5	2786	2917	1.05
	MAHIMAHI	5	354	528	1.49
	WAHOO	1	124	175	1.41
	BILLFISH TOTAL	5	2308	2214	0.96
	BLUE MARLIN	5	1516	1501	0.99
	SAILFISH	5	792	713	0.90
	TUNAS TOTAL	12	41784	26684	0.64
	PMUS & TUNAS	12	44570	29601	0.66
	ALL PELAGICS	12	44570	29601	0.66
BOTTOMFISH	PMUS TOTAL	28	1546	4616	2.99
	MAHIMAHI	1	8	9	1.11
	WAHOO	15	815	3343	4.10
	SHARKS	12	723	1264	1.75
	TUNAS TOTAL	15	441	497	1.13
	PMUS & TUNAS	42	1987	5113	2.57
	PELAGICS-MISC. TOTAL	51	531	898	1.69
	RAINBOW RUNNER	14	129	198	1.54
	MISC. TROLL FISH	42	402	700	1.74
	ALL PELAGICS	85	2518	6011	2.39

Table 4 (Cont.)

FISHING METHOD	SPECIES	NUMBER TRIPS	WEIGHT (LBS)	REVENUE ($)	PRICE ($/LB)
TROLLING-BOTTOMFISH	PMUS TOTAL	3	68	81	1.20
	WAHOO	3	68	81	1.20
	TUNAS TOTAL	20	1482	1328	0.90
	PMUS & TUNAS	20	1550	1409	0.91
	PELAGICS-MISC. TOTAL	19	2755	2350	0.85
	RAINBOW RUNNER	3	64	64	1.01
	MISC. TROLL FISH	18	2691	2286	0.85
	ALL PELAGICS	32	4305	3759	0.87
ALL GEARS	PMUS TOTAL	100	10832	12819	1.18
	MAHIMAHI	53	1808	2230	1.23
	WAHOO	45	1638	4329	2.64
	BILLFISH TOTAL	22	6663	4996	0.75
	BLUE MARLIN	19	5674	4105	0.72
	SAILFISH	8	989	891	0.90
	SHARKS	12	723	1264	1.75
	TUNAS TOTAL	502	198724	118099	0.59
	PMUS & TUNAS	528	209556	130918	0.62
	PELAGICS-MISC. TOTAL	244	26657	22650	0.85
	RAINBOW RUNNER	86	2304	2441	1.06
	MISC. TROLL FISH	181	24353	20209	0.83
	ALL PELAGICS	667	236213	153568	0.65

Table 5

AMERICAN SAMOA 1985 ANNUAL ESTIMATED
COMMERCIAL LANDINGS OF PELAGIC SPECIES
DEPARTMENT OF MARINE AND WILDLIFE RESOURCES

EFFORT, SALES, AND REVENUE
BY METHOD AND SPECIES

FISHING METHOD	SPECIES	NUMBER TRIPS	WEIGHT (LBS)	REVENUE ($)	PRICE ($/LB)
TROLLING-SURFACE	PMUS TOTAL	89	8849	15984	1.81
	MAHIMAHI	64	5354	12531	2.34
	WAHOO	32	1139	1033	0.91
	BILLFISH TOTAL	8	1904	1904	1.00
	BLUE MARLIN	5	1621	1621	1.00
	SAILFISH	3	283	283	1.00
	SHARKS	3	452	516	1.14
	TUNAS TOTAL	298	52037	48227	0.93
	PMUS & TUNAS	334	60886	64211	1.05
	PELAGICS-MISC. TOTAL	75	11392	7924	0.70
	RAINBOW RUNNER	20	537	537	1.00
	MISC. TROLL FISH	56	10855	7387	0.68
	ALL PELAGICS	381	72278	72135	1.00
LONGLINE-TUNA	PMUS TOTAL	10	5597	5484	0.98
	MAHIMAHI	9	1410	1576	1.12
	WAHOO	6	648	369	0.57
	BILLFISH TOTAL	10	3539	3539	1.00
	BLUE MARLIN	8	1156	1156	1.00
	SAILFISH	10	2383	2383	1.00
	TUNAS TOTAL	10	41488	41050	0.99
	PMUS & TUNAS	10	47085	46534	0.99
	PELAGICS-MISC. TOTAL	4	215	375	1.74
	MISC. TROLL FISH	4	215	375	1.74
	ALL PELAGICS	10	47300	46909	0.99
BOTTOMFISH	PMUS TOTAL	9	536	1440	2.69
	MAHIMAHI	4	100	100	1.00
	WAHOO	5	436	1340	3.08
	TUNAS TOTAL	27	577	567	0.98
	PMUS & TUNAS	36	1113	2007	1.80
	PELAGICS-MISC. TOTAL	14	152	236	1.55
	MISC. TROLL FISH	14	152	236	1.55
	ALL PELAGICS	49	1265	2243	1.77

Table 5 (Cont.)

FISHING METHOD	SPECIES	NUMBER TRIPS	WEIGHT (LBS)	REVENUE ($)	PRICE ($/LB)
TROLLING-BOTTOMFISH	PMUS TOTAL	15	1067	1601	1.50
	MAHIMAHI	8	300	669	2.23
	WAHOO	5	115	137	1.19
	BILLFISH TOTAL	1	78	78	1.00
	SAILFISH	1	78	78	1.00
	SHARKS	3	574	717	1.25
	TUNAS TOTAL	56	6709	6231	0.93
	PMUS & TUNAS	64	7776	7832	1.01
	PELAGICS-MISC. TOTAL	26	1926	1380	0.72
	RAINBOW RUNNER	1	21	21	1.00
	MISC. TROLL FISH	25	1905	1359	0.71
	ALL PELAGICS	86	9702	9212	0.95
STATIC FISHING	PELAGICS-MISC. TOTAL	1	120	84	0.70
	MISC. TROLL FISH	1	120	84	0.70
	ALL PELAGICS	1	120	84	0.70
ALL GEARS	PMUS TOTAL	123	16049	24509	1.53
	MAHIMAHI	85	7164	14876	2.08
	WAHOO	48	2338	2879	1.23
	BILLFISH TOTAL	19	5521	5521	1.00
	BLUE MARLIN	13	2777	2777	1.00
	SAILFISH	14	2744	2744	1.00
	SHARKS	6	1026	1233	1.20
	TUNAS TOTAL	390	100811	96075	0.95
	PMUS & TUNAS	443	116860	120584	1.03
	PELAGICS-MISC. TOTAL	120	13805	9999	0.72
	RAINBOW RUNNER	21	558	558	1.00
	MISC. TROLL FISH	100	13247	9441	0.71
	ALL PELAGICS	525	130665	130583	1.00

Table 6

AMERICAN SAMOA 1986 ANNUAL ESTIMATED
COMMERCIAL LANDINGS OF PELAGIC SPECIES
DEPARTMENT OF MARINE AND WILDLIFE RESOURCES

EFFORT, SALES, AND REVENUE
BY METHOD AND SPECIES

FISHING METHOD	SPECIES	NUMBER TRIPS	WEIGHT (LBS)	REVENUE ($)	PRICE ($/LB)
TROLLING-SURFACE	PMUS TOTAL	183	14060	19396	1.38
	MAHIMAHI	143	8461	13194	1.56
	WAHOO	34	1256	1733	1.38
	BILLFISH TOTAL	26	3666	3792	1.03
	BLUE MARLIN	23	3567	3693	1.04
	SAILFISH	3	99	99	1.00
	SHARKS	4	677	677	1.00
	TUNAS TOTAL	806	149268	121892	0.82
	PMUS & TUNAS	829	163328	141288	0.87
	PELAGICS-MISC. TOTAL	20	289	346	1.20
	RAINBOW RUNNER	11	126	136	1.08
	MISC. TROLL FISH	9	163	210	1.29
	ALL PELAGICS	829	163617	141634	0.87
BOTTOMFISH	PMUS TOTAL	4	128	182	1.42
	WAHOO	3	104	151	1.45
	SHARKS	1	24	31	1.28
	TUNAS TOTAL	8	379	488	1.29
	PMUS & TUNAS	12	507	670	1.32
	PELAGICS-MISC. TOTAL	7	379	310	0.82
	MISC. TROLL FISH	7	379	310	0.82
	ALL PELAGICS	19	886	980	1.11
TROLLING-BOTTOMFISH	PMUS TOTAL	54	3431	4763	1.39
	MAHIMAHI	48	1943	2584	1.33
	WAHOO	16	952	1375	1.44
	BILLFISH TOTAL	3	499	748	1.50
	BLUE MARLIN	3	499	748	1.50
	SHARKS	1	37	56	1.50
	TUNAS TOTAL	273	21784	18886	0.87
	PMUS & TUNAS	279	25215	23649	0.94
	PELAGICS-MISC. TOTAL	9	349	354	1.01
	RAINBOW RUNNER	3	65	65	1.00
	MISC. TROLL FISH	6	284	289	1.02
	ALL PELAGICS	283	25564	24003	0.94

Table 6 (Cont.)

FISHING METHOD	SPECIES	NUMBER TRIPS	WEIGHT (LBS)	REVENUE ($)	PRICE ($/LB)
ALL GEARS	PMUS TOTAL	241	17619	24341	1.38
	MAHIMAHI	191	10404	15778	1.52
	WAHOO	53	2312	3259	1.41
	BILLFISH TOTAL	29	4165	4540	1.09
	BLUE MARLIN	26	4066	4441	1.09
	SAILFISH	3	99	99	1.00
	SHARKS	6	738	764	1.03
	TUNAS TOTAL	1087	171431	141266	0.82
	PMUS & TUNAS	1120	189050	165607	0.88
	PELAGICS-MISC. TOTAL	36	1017	1010	0.99
	RAINBOW RUNNER	14	191	201	1.06
	MISC. TROLL FISH	22	826	809	0.98
	ALL PELAGICS	1131	190067	166617	0.88

Table 7

AMERICAN SAMOA 1987 ANNUAL ESTIMATED
COMMERCIAL LANDINGS OF PELAGIC SPECIES
DEPARTMENT OF MARINE AND WILDLIFE RESOURCES

EFFORT, SALES, AND REVENUE
BY METHOD AND SPECIES

FISHING METHOD	SPECIES	NUMBER TRIPS	WEIGHT (LBS)	REVENUE ($)	PRICE ($/LB)
TROLLING-SURFACE	PMUS TOTAL	64	4394	4909	1.12
	MAHIMAHI	50	2264	2838	1.25
	WAHOO	21	974	915	0.94
	BILLFISH TOTAL	6	1156	1156	1.00
	SAILFISH	6	1156	1156	1.00
	TUNAS TOTAL	503	120772	97221	0.80
	PMUS & TUNAS	509	125166	102130	0.82
	PELAGICS-MISC. TOTAL	13	202	275	1.36
	RAINBOW RUNNER	4	19	15	0.80
	MISC. TROLL FISH	9	183	260	1.42
	ALL PELAGICS	509	125368	102405	0.82
BOTTOMFISH	PMUS TOTAL	2	157	517	3.30
	WAHOO	2	157	517	3.30
	TUNAS TOTAL	7	154	189	1.22
	PMUS & TUNAS	9	311	706	2.27
	ALL PELAGICS	9	311	706	2.27
TROLLING-BOTTOMFISH	PMUS TOTAL	10	532	729	1.37
	MAHIMAHI	4	125	125	1.00
	WAHOO	6	175	418	2.39
	BILLFISH TOTAL	3	232	186	0.80
	BLUE MARLIN	3	232	186	0.80
	TUNAS TOTAL	143	12063	12970	1.08
	PMUS & TUNAS	143	12595	13699	1.09
	ALL PELAGICS	143	12595	13699	1.09
ALL GEARS	PMUS TOTAL	76	5083	6155	1.21
	MAHIMAHI	54	2389	2963	1.24
	WAHOO	29	1306	1850	1.42
	BILLFISH TOTAL	9	1388	1342	0.97
	BLUE MARLIN	3	232	186	0.80
	SAILFISH	6	1156	1156	1.00
	TUNAS TOTAL	653	132989	110380	0.83
	PMUS & TUNAS	661	138072	116535	0.84
	PELAGICS-MISC. TOTAL	13	202	275	1.36
	RAINBOW RUNNER	4	19	15	0.80
	MISC. TROLL FISH	9	183	260	1.42
	ALL PELAGICS	661	138274	116810	0.84

Table 8

AMERICAN SAMOA 1988 ANNUAL ESTIMATED
COMMERCIAL LANDINGS OF PELAGIC SPECIES
DEPARTMENT OF MARINE AND WILDLIFE RESOURCES

EFFORT, SALES, AND REVENUE
BY METHOD AND SPECIES

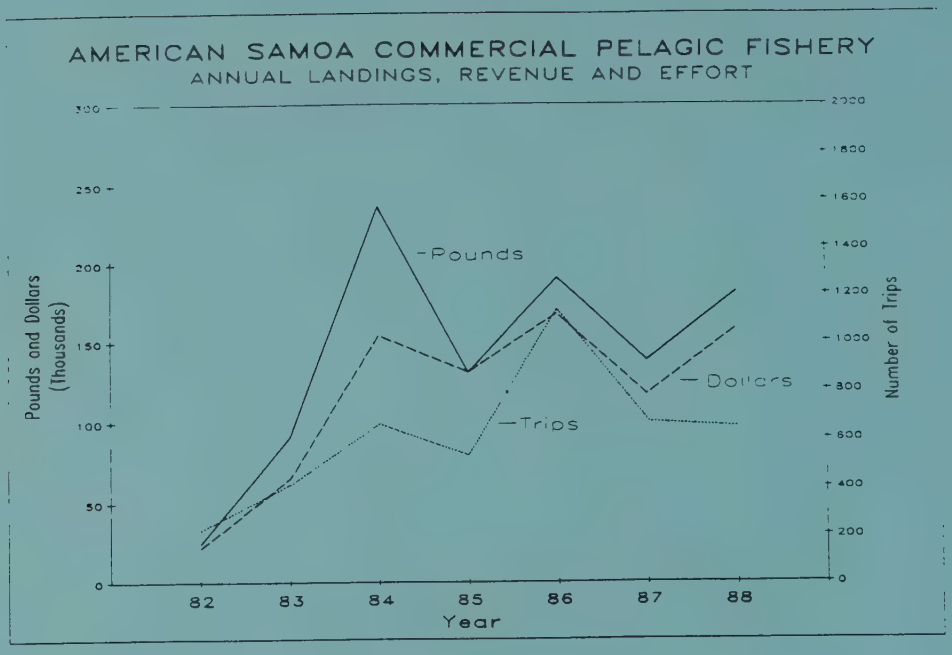
FISHING METHOD	SPECIES	NUMBER TRIPS	WEIGHT (LBS)	REVENUE ($)	PRICE ($/LB)
TROLLING-SURFACE	PMUS TOTAL	93	10024	14249	1.42
	MAHIMAHI	60	5169	10499	2.03
	WAHOO	22	544	758	1.39
	BILLFISH TOTAL	15	3828	2871	0.75
	BLUE MARLIN	11	3751	2813	0.75
	SAILFISH	4	77	58	0.75
	SHARKS	7	483	121	0.25
	TUNAS TOTAL	433	154917	121169	0.78
	PMUS & TUNAS	449	164941	135418	0.82
	PELAGICS-MISC. TOTAL	31	722	837	1.16
	RAINBOW RUNNER	23	408	445	1.09
	MISC. TROLL FISH	8	314	392	1.25
	ALL PELAGICS	450	165663	136255	0.82
LONGLINE-TUNA	PMUS TOTAL	4	93	140	1.50
	WAHOO	4	93	140	1.50
	TUNAS TOTAL	25	2702	4786	1.77
	PMUS & TUNAS	25	2795	4926	1.76
	ALL PELAGICS	25	2795	4926	1.76
BOTTOMFISH	PMUS TOTAL	3	174	43	0.25
	SHARKS	3	174	43	0.25
	TUNAS TOTAL	17	457	796	1.74
	PMUS & TUNAS	20	631	839	1.33
	PELAGICS-MISC. TOTAL	32	467	736	1.58
	RAINBOW RUNNER	3	17	27	1.60
	MISC. TROLL FISH	32	450	709	1.58
	ALL PELAGICS	49	1098	1575	1.44
TROLLING-BOTTOMFISH	PMUS TOTAL	24	828	1317	1.59
	MAHIMAHI	17	296	518	1.75
	WAHOO	13	532	799	1.50
	TUNAS TOTAL	96	9178	12422	1.35
	PMUS & TUNAS	100	10006	13739	1.37
	PELAGICS-MISC. TOTAL	27	752	1109	1.48
	RAINBOW RUNNER	5	121	181	1.50
	MISC. TROLL FISH	26	631	928	1.47
	ALL PELAGICS	106	10758	14848	1.38

Table 8 (Cont.)

FISHING METHOD	SPECIES	NUMBER TRIPS	WEIGHT (LBS)	REVENUE ($)	PRICE ($/LB)
SPEAR	TUNAS TOTAL	7	227	274	1.21
	PMUS & TUNAS	7	227	274	1.21
	PELAGICS-MISC. TOTAL	7	319	481	1.51
	MISC. TROLL FISH	7	319	481	1.51
	ALL PELAGICS	14	546	755	1.38
ALL GEARS	PMUS TOTAL	124	11119	15749	1.42
	MAHIMAHI	77	5465	11017	2.02
	WAHOO	39	1169	1697	1.45
	BILLFISH TOTAL	15	3828	2871	0.75
	BLUE MARLIN	11	3751	2813	0.75
	SAILFISH	4	77	58	0.75
	SHARKS	10	657	164	0.25
	TUNAS TOTAL	578	167481	139447	0.83
	PMUS & TUNAS	601	178600	155196	0.87
	PELAGICS-MISC. TOTAL	97	2260	3163	1.40
	RAINBOW RUNNER	31	546	653	1.20
	MISC. TROLL FISH	73	1714	2510	1.47
	ALL PELAGICS	644	180860	158359	0.88

APPENDIX B: FIGURES

Figure 1



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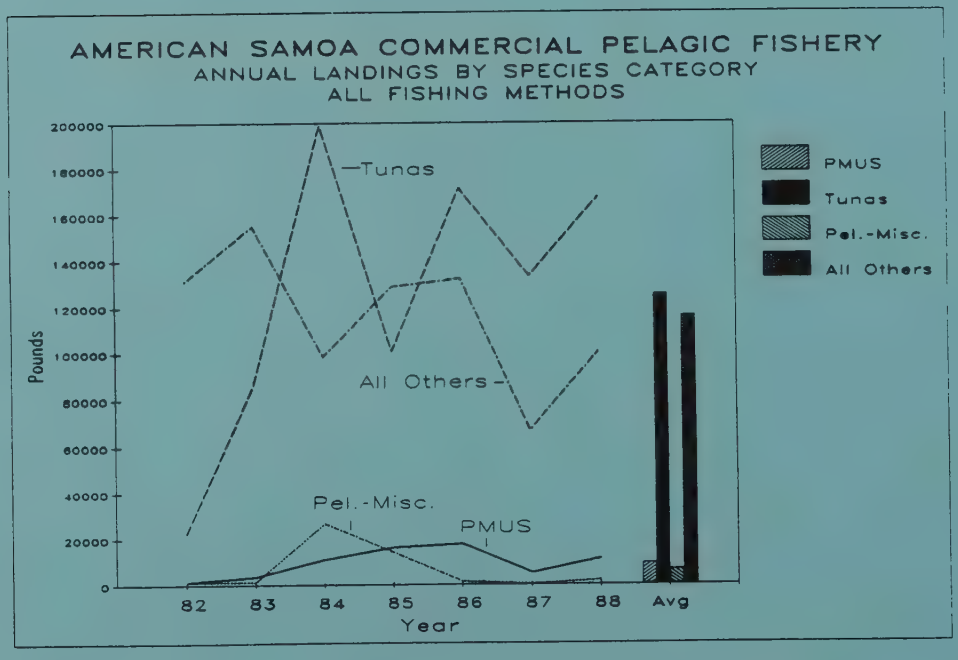

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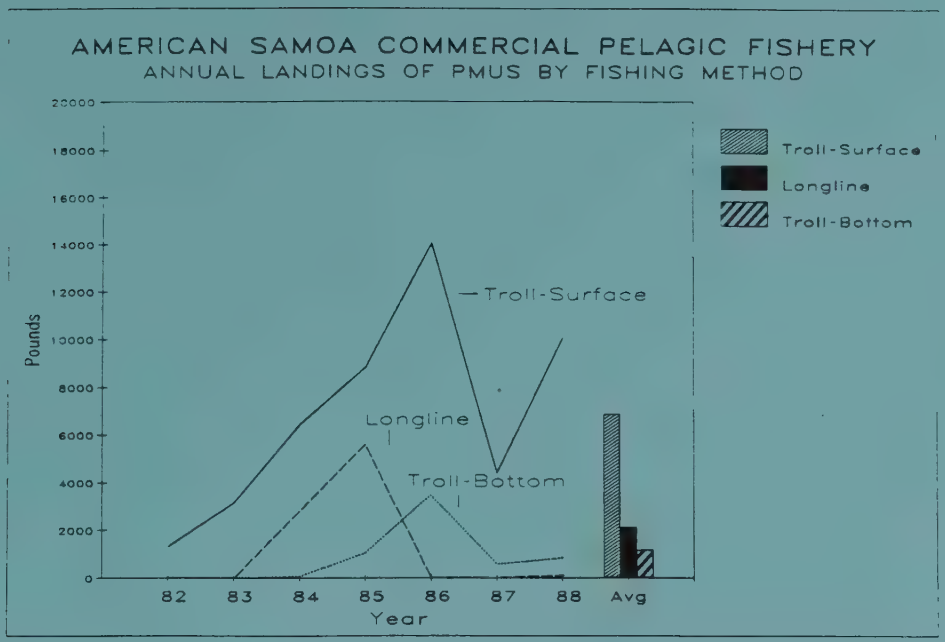

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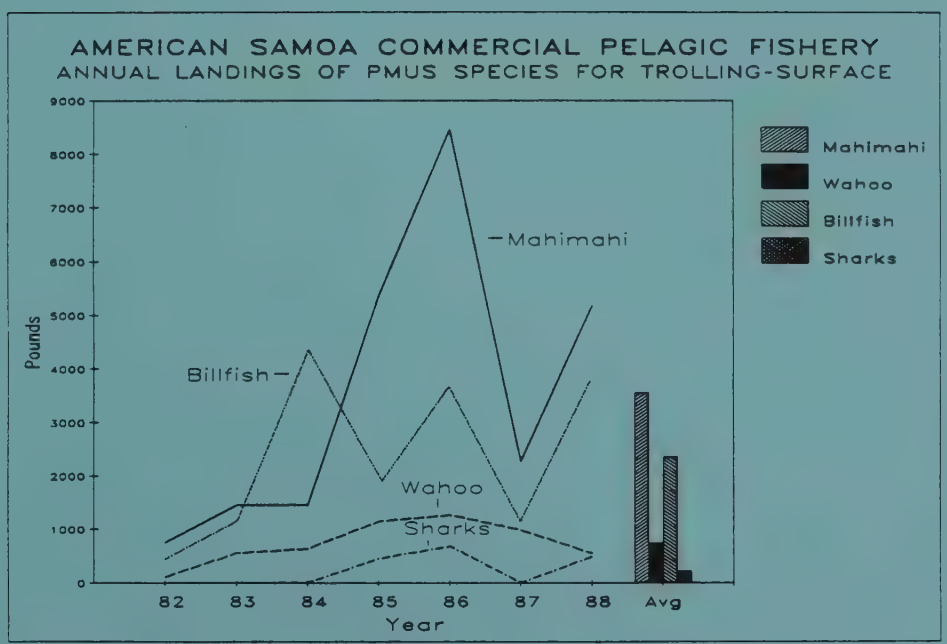

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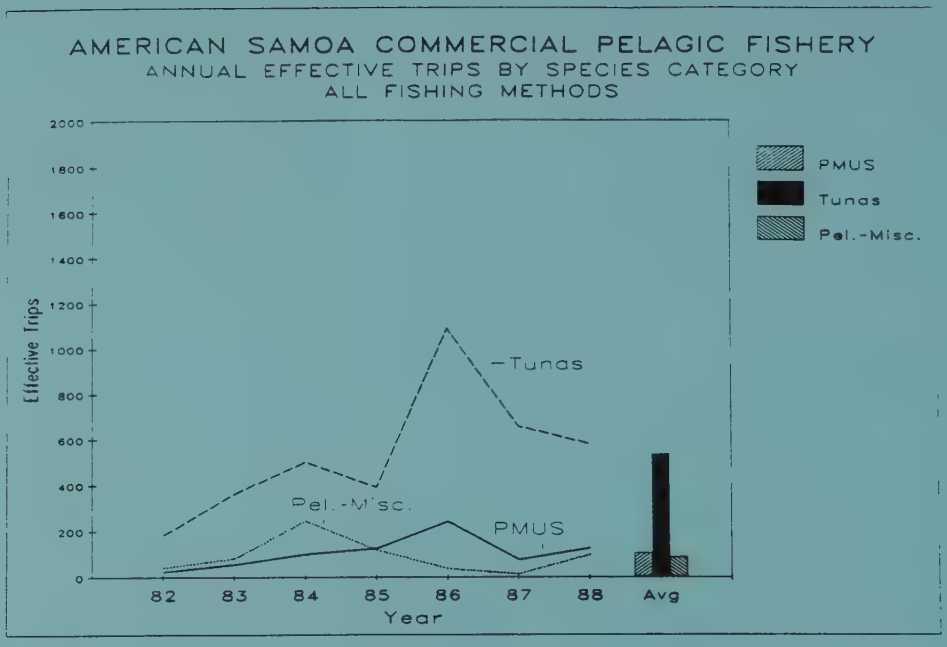

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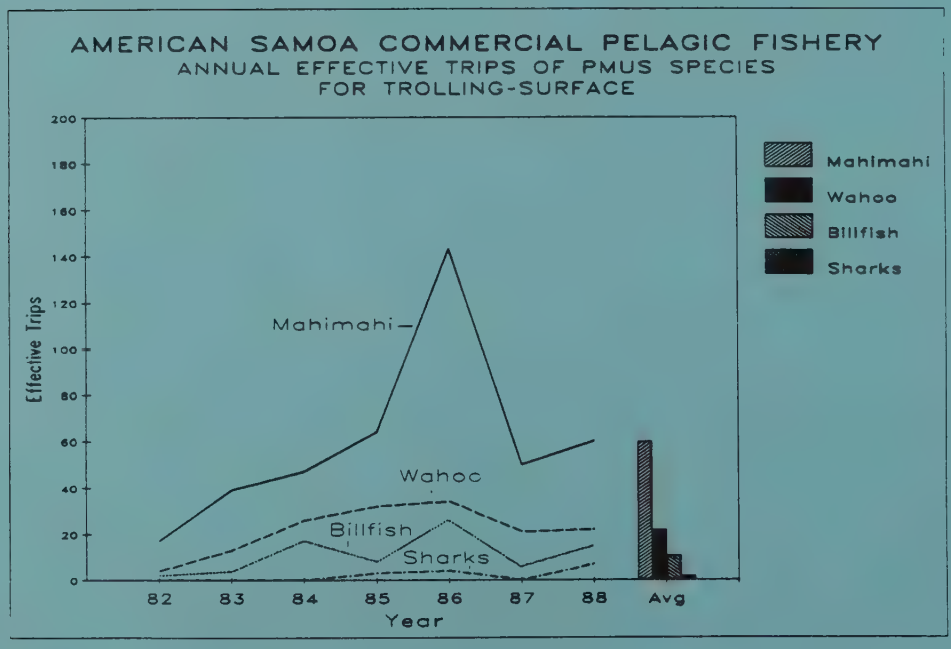

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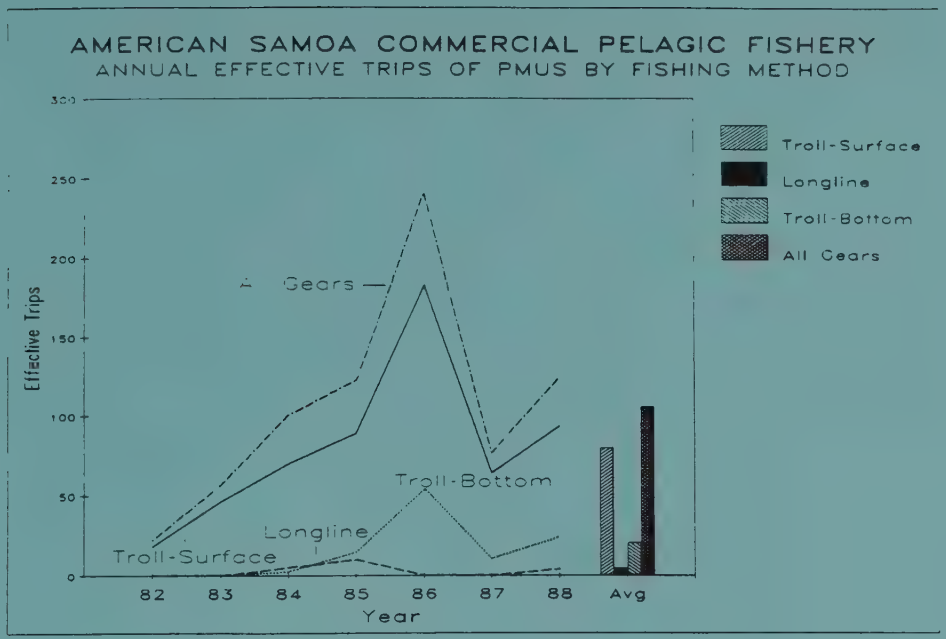

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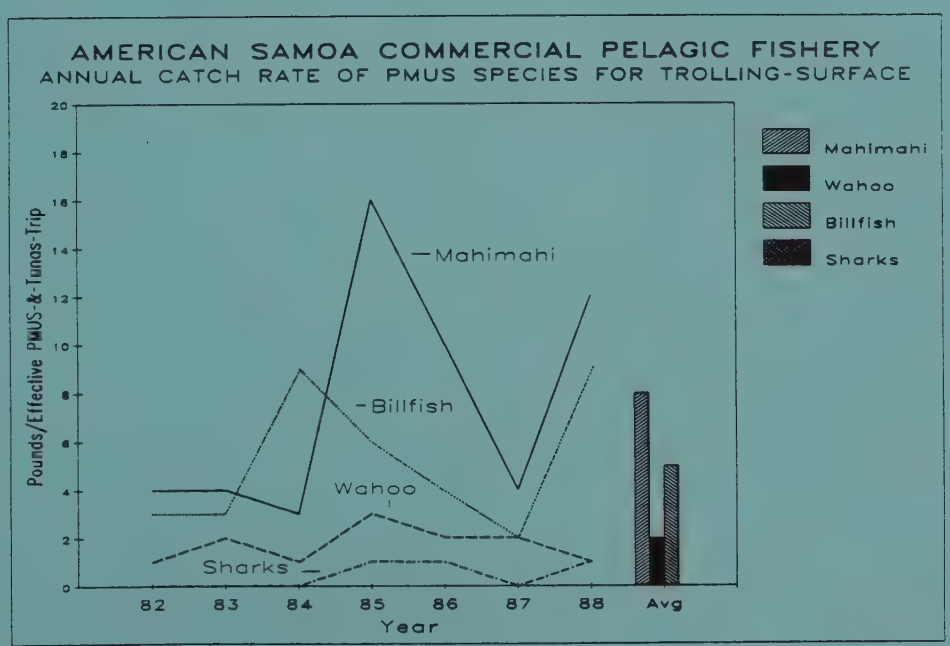

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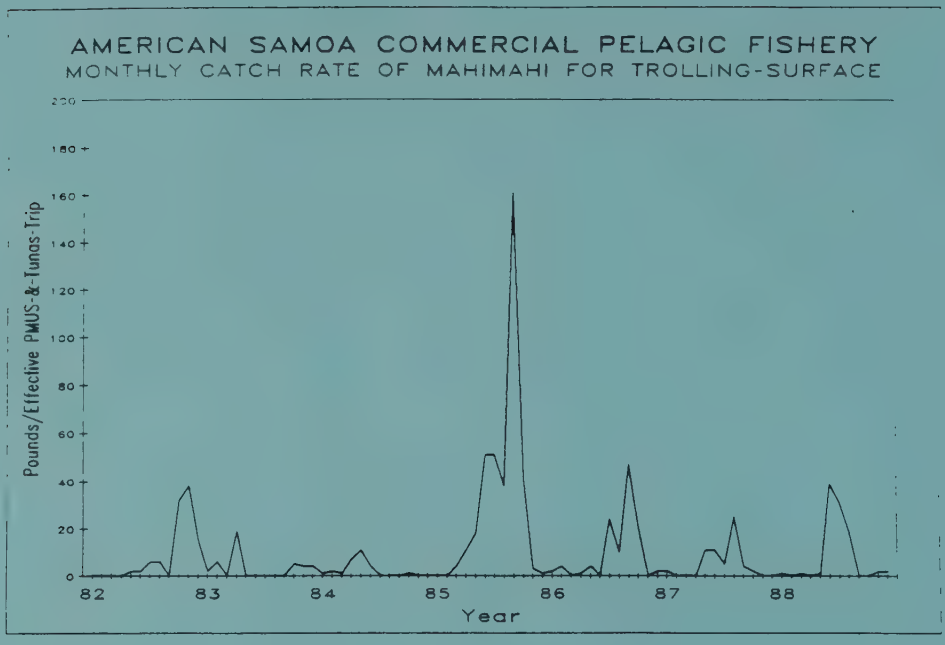

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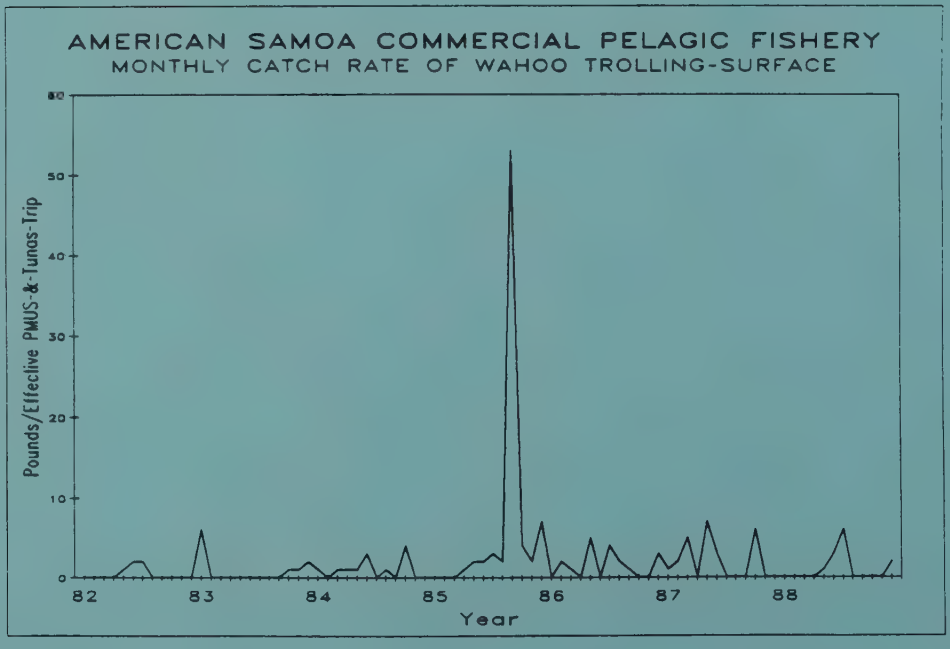

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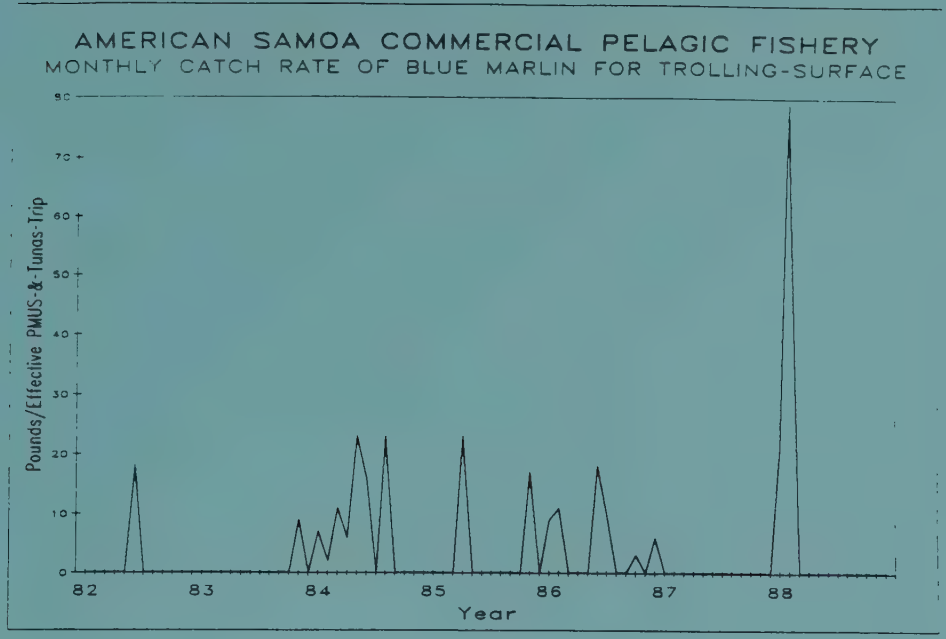

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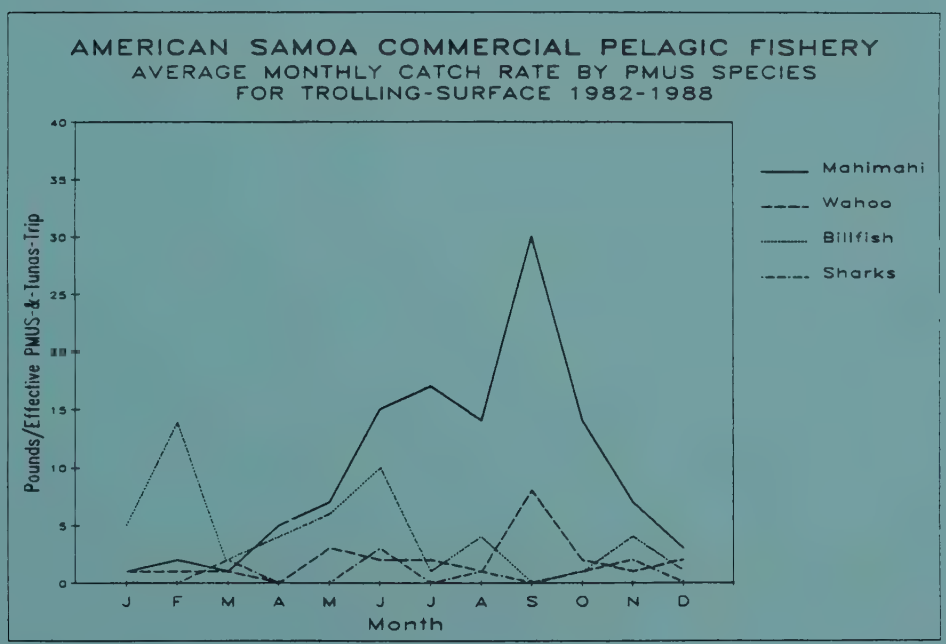

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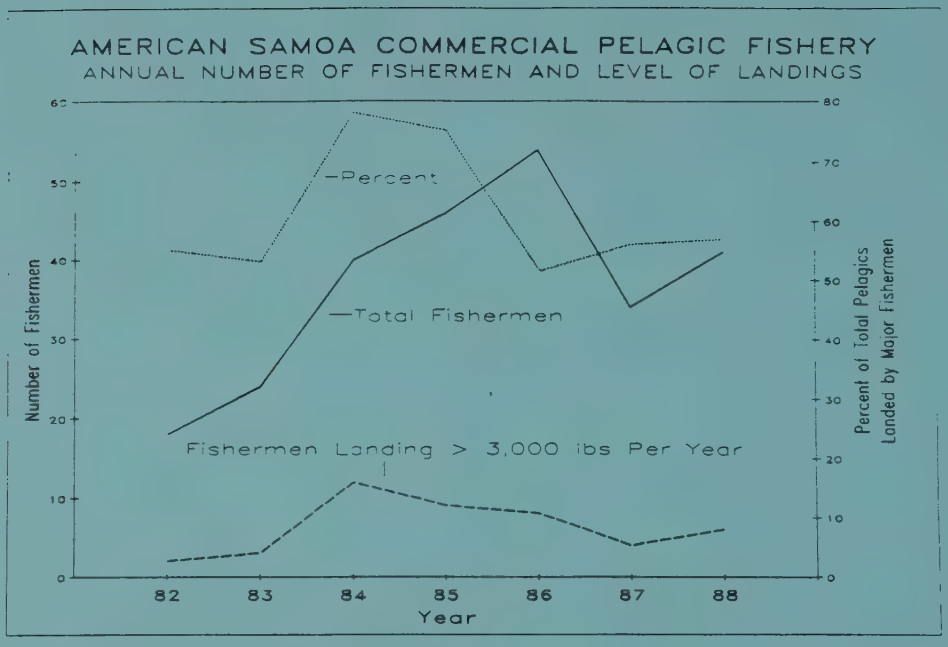
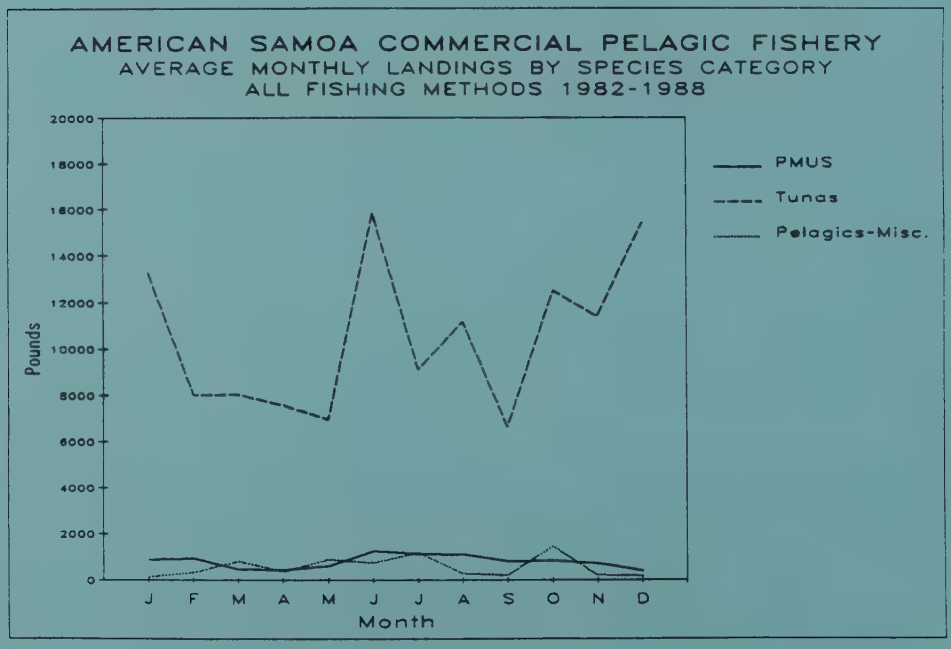


Figure 14



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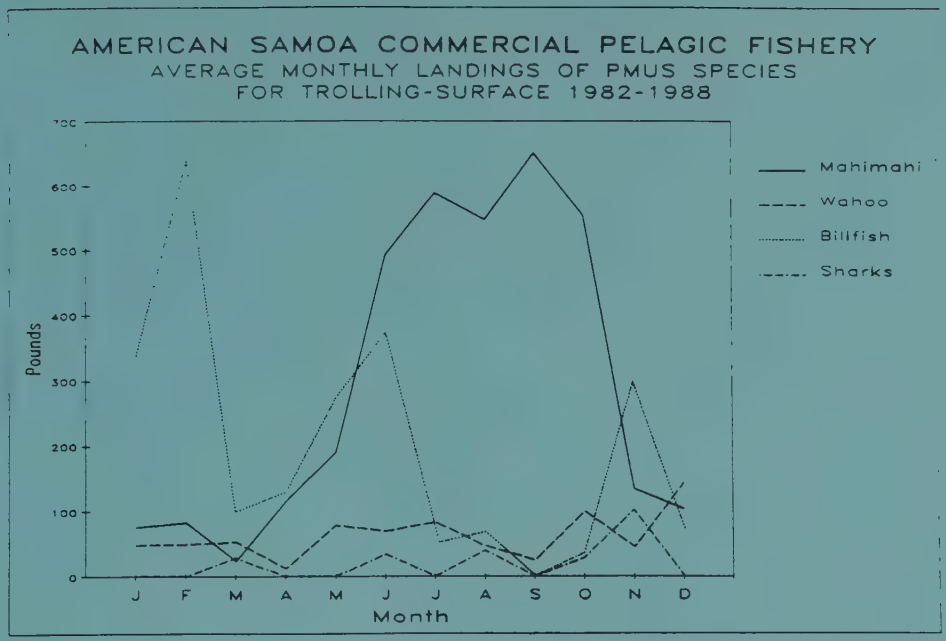

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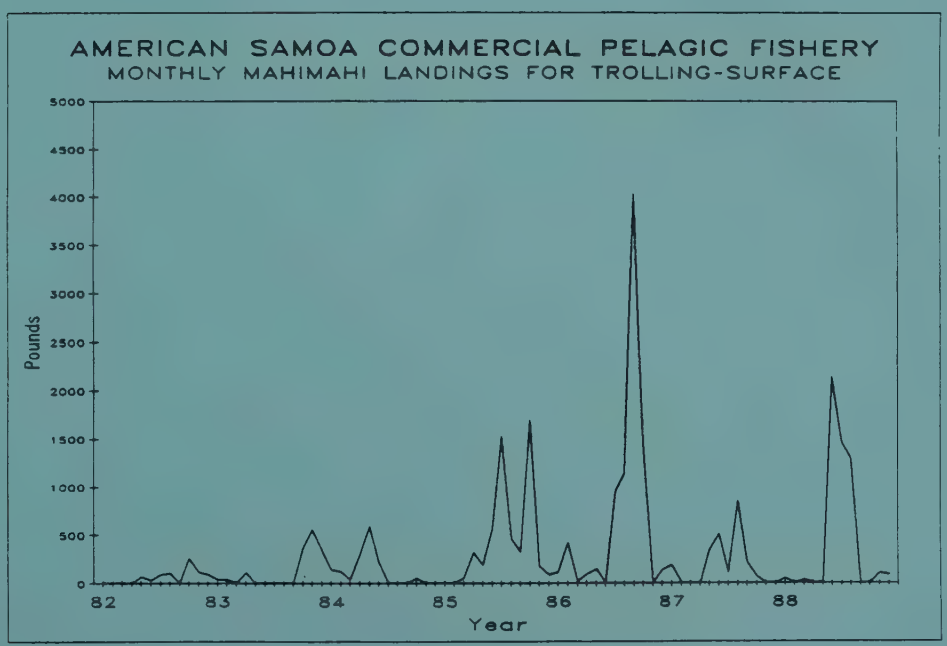
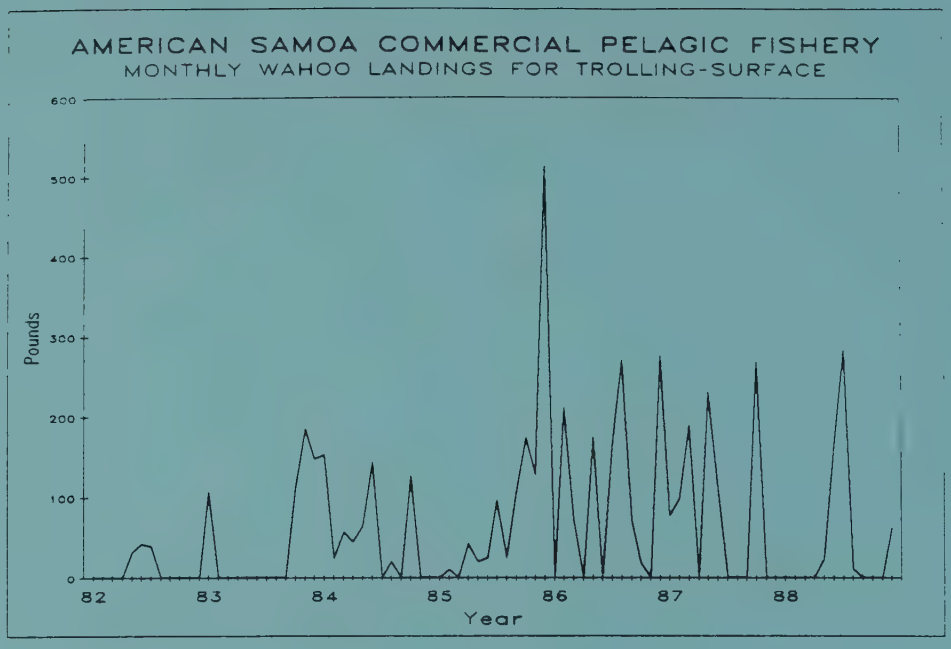


Figure 17



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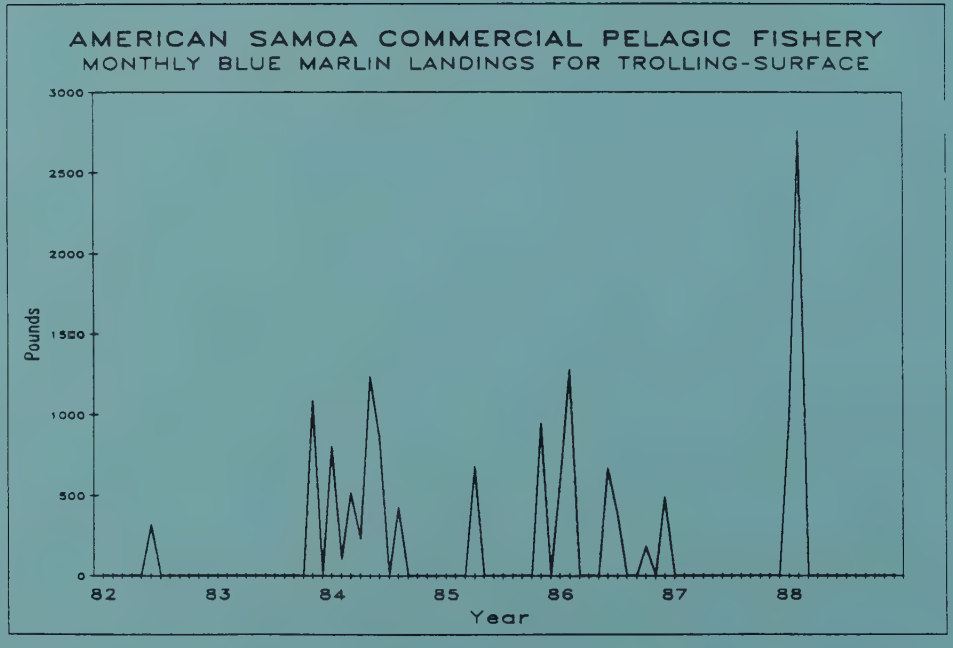

GUAM FISHERY MODULE

ANNUAL REPORT FOR THE 1988 PELAGIC FISHERIES OF THE TERRITORY OF GUAM

JUNE 1989

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PELAGIC PLAN MONITORING TEAM

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INTRODUCTION

The Fishery Management Plan (FMP) for the Pelagic Fisheries of the Western Pacific Region was implemented by the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA Fisheries) in 1987. The Western Pacific Regional Fishery Management Council (Council) developed the FMP to manage the pelagic resources occurring in its area of jurisdiction as defined in the Magnuson Fishery Management and Conservation Act of 1976. The management goal of the Pelagic FMP is to maintain pelagic stocks at optimal population levels while managing foreign fishing; promoting equitable domestic utilization of the resources by commercial, subsistence, and recreational sectors; eliminating waste from incidental harvest; and diminishing the risk of gear conflicts.

The pelagic management unit species (PMUS) covered by this FMP are given below.

Common Name	Scientific Name
Mahimahi (dolphinfish)	Coryphaena hippurus
Pompano dolphinfish	C. equiselis
Wahoo	Acanthocybium solandri
Indo-Pacific blue marlin	Makaira mazara
Black marlin	M. indica
Striped marlin	Tetrapturus audax
Shortbill spearfish	T. angustirostris
Swordfish	Xiphias gladius
Requiem sharks	Carcharhinidae
Thresher sharks	Alopiidae
Hammerhead sharks	Sphyrnidae
Mackerel sharks	Lamnidae

The Pelagic FMP required the Council to establish a Pelagic Plan Monitoring Team (Team) to prepare an annual report on the status of the pelagic fisheries for each of the island areas served by the Council. The Team decided to adopt a modular approach to developing the annual report, whereby each island area would develop an individual report for its pelagic fishery and would submit the report to the Team for review. This report module is submitted to the Team to help determine the effectiveness of the FMP in meeting its goal in Guam.

Preparation of this report was a cooperative effort among staff of NOAA Fisheries Honolulu Laboratory's Western Pacific Fishery Information Network (WPACFIN), a contractor of the Council, and a newly appointed Team member from the Guam Division of Aquatic and Wildlife Resources (DAWR). Some of the tables and figures were prepared by the contractor using computer programs developed specifically for the Council for that purpose; other data summaries, tables, and figures were prepared by WPACFIN staff using ad-hoc programs and data base queries. This report is based on two major sets of data: commercial landings data collected by WPACFIN through a voluntary reporting system established by WPACFIN in 1982 with major fresh fish dealers on

Guam, and creel survey data collected by the DAWR. The WPACFIN Program Manager and DAWR staff biologists have reviewed and discussed the data in this report. Through cooperative efforts of the agencies involved, this annual report on the pelagic fishery of Guam is DAWR's official submission to the Team for the 1988 calendar year.

Both data collection systems used to monitor Guam's fisheries have limitations related to the sample size included in the data bases; hence, data from both systems are presented to provide a more complete and accurate description of the fishery. The percent coverage obtained through the commercial landings data collection system in the last 2-3 years probably has been steadily declining. Therefore, it is believed that the usability of this data set to directly monitor the fisheries of Guam is also decreasing. No adjustment factors have yet been devised to help alleviate changes in percent coverage of the commercial data. Additionally, marketing problems on Guam in the past 2 years have resulted in limits being placed on the quantity of fish that would be purchased from each trip for certain in-season species, e.g., mahimahi and skipjack tuna.

This report provides various summary statistics on the pelagic fishery of Guam from both the commercial and creel survey data sets for 1979-88. It does not review all previously described and published detailed information on the fishery. For additional background information on Guam's data collection systems, assumptions, and analyses used to summarize data in this report, the pelagic fishery, or specifics on other Guam fisheries refer to the DAWR annual reports, the Team's first annual report, or volumes of WPACFIN's "Fishery Statistics of the Western Pacific" (Hamm et al. 1986; Hamm and Quach 1988, 1989).

FISHERY PERFORMANCE DATA

Commercial fishery performance data are summarized in Tables 1-5 and Figures 1-29 in Appendices A and B, respectively. The figures represent alternative methods of viewing the data, but neither the text nor analyses fully explore the meaning or application of all of the figures. Although tuna species are not covered by the FMP, they are included in various tables and figures because they are as important as the PMUS to the pelagic fishery in Guam. Commercial harvesting of shark species is low compared with PMUS and tunas. Annual summaries for years prior to 1988 have been included in this report because species subtotals not provided in the first annual report have been added to the tables. For brevity, tables of monthly statistics are not included in this report, but are available for review at the Honolulu Laboratory. Comments on the data summarized in the tables and figures are provided under the following subsections as identified in the FMP.

1. Total Catch, Foreign and Domestic, by Species and Gear

No licensed foreign fishing under the FMP has taken place since the plan came into effect; hence, there are no foreign data to summarize. Total domestic "catch" data are not available, only "landings," which are reported below.

2. Total Landings and Estimated Revenues by Species and Gear

Domestic commercial landings of pelagic species in 1988 equaled 141,632 pounds worth $193,234. Table 5 provides the breakdown by species and gear. Comparison of the commercial landings and creel survey estimated total landings shows a serious problem in using only the commercial data for monitoring purposes, i.e., declining commercial landings but greatly increased total landings in 1988 (Figure 1). The commercial landings of mahimahi were essentially the same in 1988 as in 1987, but the creel survey estimates showed an all-time record mahimahi season in 1988--nearly four times as large as the 1987 season (Figure 2).

3. Fishing Effort

Fishing effort was estimated in terms of the effective number of trips in which each pelagic species or species group was landed. An effective trip for a particular species (or species category) is defined as a fishing trip resulting in the landing of said species (or species category). The number of recorded commercial trips landing any pelagic species declined slightly for the third year in a row (Figures 3 and 4). Creel survey data for 1988 indicate about a 70% increase over 1987 in the total number of trolling trips (Figures 3 and 5). Creel survey data show over a 50% increase in the number of hours spent trolling (Figure 5). Commercial data show a decreasing level of effort in terms of the total number of trips (Figure 3), the number of trips by species category (Figure 6), number of vessels (Figure 7), and average length of a trip (Figure 8). The number of effective trips by PMUS decreased for wahoo, billfish, and sharks, but slightly increased for mahimahi (Figure 9).

4. Annual and Quarterly Catch Rate by Species and Gear

Catch rate is calculated by dividing the landed weight of a species (or species category) by the number of trips resulting in a landing of any of the pelagic species, including tunas. Quarterly catch rates are not provided; however, annual, monthly, and average monthly commercial catch rates for combined trolling and unspecified fishing methods are summarized in Figures 10, 11-13, and 14, respectively. As expected, catch rates were highest during the peak seasons for each species.

5. Relationships Among Fishery Sectors

5.1 Species Categories

Pelagic species generally comprise 70-90% of the annual commercial landings (Table 1) and 80-90% of the estimated total landings (Figure 15). Annual commercial landings of the PMUS are typically larger than tunas and all other categories (Figure 16). Estimated total landings of the PMUS have been higher than the tunas for the past 4 years but, before that, fluctuated in importance relative to the tunas (Figure 15).

5.2 Fishing Methods

Trolling is, by far, the most important method used in Guam to catch pelagic species. The commercial landings system first began recording the fishing methods in late 1982. Before that, all landings were by unspecified methods (Figure 17). Since 1983, recording of data by wholesalers has continued to improve with respect to identification of the method used to capture the fish; hence, the continued decline in the landings of pelagic fishes (Figure 17) and PMUS (Figure 18) is attributed to unspecified methods. A safe assumption is that essentially all catches of pelagic fishes by unspecified methods were actually caught by trolling.

Two other fishing methods that target pelagic species were used to a small degree in Guam in 1982-83, longline and ika-shibi (Figure 19). The longlining was actually done as an experimental fishing project and recorded sold fish from six trips in 1983. Also, in 1983, two boats reportedly tried ika-shibi fishing on one trip each. Catch rate for these two trips were high, so it seems curious that the method did not develop into a regular fishery. The 1987 longline landings shown in Figure 19 were actually from a foreign vessel and should have been coded as "imports," not as domestic longline effort. The large and fast-growing foreign longline fishery operating out of Guam may influence the development of a domestic longline fleet in the future.

The commercial landings data base also records incidental pelagic landings for a variety of other fishing methods, e.g., jigging, bottom fishing, and spearfishing (Figure 20). Most of these landings are actually data coding errors by the wholesalers; that is, the pelagic species were caught by trolling, but the fishing trip included the other method as well. The commercial landings system was designed to record the method of capture, so most of the landings recorded for these incidental methods are considered errors. The 1988 data are considered errorfree with respect to recorded fishing method because they were carefully scrutinized and reviewed by WPACFIN staff and the wholesaler who submitted the data. The 1988 data show that virtually all of the pelagic fishes (99.98% by weight) were landed by trolling.

5.3 Fishery Stability

A total of 359 fishermen (boats) have landed pelagic fish commercially since 1980. The 81 boats that landed pelagic species commercially in 1988 was the lowest number on record. The number of highliners, the most productive fishermen (defined herein as those landings over 5,000 pounds of pelagic fish), continued to decline in 1988 to only eight, the fewest since 1982 (Figure 7). The number of big highliners, e.g., those landings over 10,000 pounds, declined to zero in 1988--down from five in 1987 (Figure 7). The average price paid for pelagic species has also declined steadily since 1986, dropping a total of $0.21 per pound (Figure 1). The pelagic commercial fishery of Guam appears to have declined significantly in recent years. Additional study is needed to further describe and document this apparent trend.

6. Species Composition

Figures 15, 16, and 21 show a fluctuating mix for the commercially landed major pelagic species. Table 4 and Figure 22 show an apparently "healthy" but fluctuating species mix for the creel survey estimated total landings of the major pelagic species. Statistical analyses of the data are needed to test whether any changes have occurred or trends exist.

7. Trends

7.1 Landings

Commercial landings of pelagic species have been steadily declining since 1985, with 1988 recording the lowest landings since 1982 (Figure 1). However, based on creel survey data, the estimated total landings of pelagic species for 1988 were the highest on record, due primarily to record high mahimahi landings (Figures 1 and 2). No statistical analyses of the data have been performed.

7.2 Fishing Effort

Commercial fishing effort seems to be steadily declining in recent years. The commercial number of trips (Figure 3), number of fishermen, number of highliners and big highliners (Figure 7), and the average length of a commercial trip (Figure 8) are all declining. However, the total fishing effort for pelagic species, as estimated through the DAWR creel surveys, is not declining (Figures 3 and 5), nor is the average length of a trolling trip (Figure 23). Statistical analyses and additional investigations are needed to better understand these apparently conflicting statistics. Marketing problems and changes and the increased charter boat fleet no doubt have had significant influences on the commercial data.

7.3 Catch Rate

Table 2 and Figure 8 and Table 3 and Figure 23 compare two methods of calculating catch per hour for the commercial and

creel survey data, respectively. Annual, long-term monthly, and average monthly catch-per-trip summaries of the commercial data (Figures 10-14) show fluctuating and possibly declining annual catch rates, distinct seasonality, and higher catch rates for each species during its highest seasonal abundance (Figures 25-29). No long-term trends in catch rates are obvious. Commercial and creel data apparently show somewhat different pictures of catch rates. Statistical analyses are needed, and the Team needs to identify which methods and which measures of catch per unit of effort (CPUE) will be used to monitor the fishery.

8. Seasonal Patterns of Fishing

No extensive analyses of seasonal patterns of fishing have been conducted to date, but trends in relative abundance of species are apparent (Figures 25-29). A feeding study by the DAWR for the major pelagic species recorded a correlation between food availability and abundance of pelagic predatory fish. This study confirms the seasonal abundance of pelagic fish around Guam as shown for the commercial landings (Figures 25-26). The DAWR has also implemented a study that will use sea surface temperatures from satellite imagery to predict migration, abundance, and occurrence of seasonal fish.

9. Size Composition

Available size composition data are not in a readily usable form and still have not been analyzed.

ENFORCEMENT ACTIVITIES, PLAN ADMINISTRATION, AND PROBLEMS

This section should be added by the NMFS Enforcement branch and the U.S. Coast Guard.

RESEARCH RESULTS

Other than the completed feeding ecology study and the newly implemented satellite imagery study mentioned above, no research projects are being conducted on pelagic species by DAWR staff.

PROBLEMS REQUIRING COUNCIL CONSIDERATION AND ACTION

Although the commercial fishery seems to be failing, the overall pelagic fishery seems fairly stable, and DAWR staff has identified no problems requiring Council action.

ASSESSMENT OF MONITORING PROCESS

Existing computer programs for summarizing and analyzing available data are insufficient to properly monitor the resource and describe the fishery. Assistance is needed to develop these tools to be used by DAWR biologists in preparation of subsequent

annual reports. The development of relevant island modules is currently limited by the vague guidelines established in the FMP. The data available since the formulation of the FMP have changed, and amendment of the FMP to reflect a new structure would be helpful. If island modules are expected to provide data, analyses, and recommendations, the procedures for types of data required, statistical approaches, and overall objectives must be specific.

RECOMMENDED ACTIONS

To date, only visual interpretations have been used on the data. More thorough and statistically valid analyses should be performed on the data to determine whether trends or problems actually exist in this fishery. The Team should identify specific questions about the fishery; form hypotheses to answer these questions; determine analytical methods to test these hypotheses; provide guidelines for interpreting the analyses; and determine what constitutes trends, changes, or problems in the fishery. The Team should develop specific recommendations for format and content of the annual report modules. A special 2- to 5-day workshop should be held, possibly in concert with the Bottomfish Team and select members of the Council's Scientific and Statistical Committee, to resolve these problems for all Council management areas.

The commercial landings system should be improved to include a broader coverage. Currently the WPACFIN staff coordinate, collect, and process the commercial landings and effort data for Guam. The DAWR has a concern and interest in collecting this information but is limited to involvement in recreational and subsistence fisheries only, because 100% of its funding is through Dingell-Johnson funds, which cannot be used for commercial activities. If the Guam report module is to include commercial data, a mechanism, e.g., funding, must be developed to support DAWR's involvement in the commercial fisheries.

Length-frequency and biological sampling of the major pelagic species should be implemented or increased if these data are to be routinely reported in the annual report modules.

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APPENDIX A: TABLES

Table 1

Summary of the Guam Commercial Pelagic Fishery 1980-88

		1980	1981	1982	1983	1984	1985	1986	1987	1988
Total commercial landings in pounds		105014	145970	140762	311029	281402	296624	237512	219507	159716
Total landings of pelagic species	pounds	88706	129748	130540	256606	196226	214179	203524	193955	141632
	dollars	111870	174707	173270	342207	257841	336876	301460	280662	193234
	avg $/lb	1.26	1.35	1.33	1.33	1.31	1.57	1.48	1.45	1.36
Percent of pelagics landings to total landings		84.5	88.9	92.7	82.5	69.7	72.2	85.7	88.3	88.7
Number of trips which landed pelagics		832	1088	1007	1783	1478	1716	1692	1646	1592
Number of fishermen (boats) landing pelagics *		99	120	89	109	96	103	87	94	81
Pelagics catch per trip		107	119	130	144	133	125	120	118	89
Total catch of pelagics										
by highliners **		24131	63742	78444	153224	104073	150880	133643	114205	51252
by big-highliners ***		0	24299	35658	119795	54462	113194	62033	78769	0
Percent of total pelagics										
landed by highliners		27	49	60	60	53	70	66	59	36
landed by big-highliners		0	19	27	47	28	53	30	41	0
Number of trips made by										
highliners		200	403	492	720	569	874	846	599	524
big-highliners		0	128	173	468	254	495	258	289	0
Number of highliners		4	8	8	11	10	12	14	10	8
Number of big-highliners		0	2	2	6	3	6	3	5	0
Catch per trip of										
highliners		121	158	159	213	183	173	158	191	98
big-highliners		0	190	206	256	214	229	240	273	0

* Number of known fishermen plus one to account for landings by miscellaneous fishermen.

** Highliners = fishermen (boats) landing over 5,000 pounds of pelagics during the year.

*** Big-highliners = fishermen (boats) landing over 10,000 pounds of pelagics during the year.

Table 2

Summary of the Guam Commercial Pelagic Fishery For Trips With Known Effort 1982-88

	1982	1983	1984	1985	1986	1987	1988
Number of fishermen	39	77	82	94	85	90	79
Percent of total pelagic fishermen	43	71	85	91	98	96	98
Number of trips	194	727	1038	1480	1652	1468	1500
Percent of total pelagic trips	19	41	70	86	98	89	94
Total hours	1833	8004	10725	13835	12263	10149	9278
Total landings	26802	99650	132355	188456	191465	174358	133526
Hours per trip	9.5	11.0	10.3	9.4	7.4	6.9	6.2
CV	72	111	103	109	77	71	63
Catch per trip	138	137	128	127	116	119	89
CV	97	111	93	115	119	126	103
Catch per hour (CPUE1) (sum catch/sum hrs) (Annual est. observation)	14.6	12.5	12.3	13.6	15.6	17.2	14.4
Catch per hour (CPUE2) (sum(catch/hrs)/sum trips) (trip is an observation)	20.7	15.8	17.2	17.9	17.3	20.3	14.6
Standard Deviation and Coefficient of Variation of CPUE							
With trip CPUE defined as a sample observation							
SD=std(lbs/hrs) (SD1)	44.6	19.2	29.7	53.6	34.4	89.4	12.9
CV=(SD1/CPUE2) (CV1)	215	121	172	299	199	441	88
With trip CPUE defined as a "mean" observation							
SD=(SD1/sqrt(trips)) (SD2)	3.2	0.7	0.9	1.4	0.9	2.3	0.3
CV=(SD2/CPUE2) (CV2)	15	4	5	8	5	12	2

Table 3

Guam DAWR Pelagic Creel Survey Summary Statistics

Year	Catch	CV	Boat hrs.	CV	Trips	CV	CPUE1**	CPUE2*	CV
1979	221289	11	31749	8	6328	7	10.0	7.2	15
1980	505562	13	41870	15	7394	9	12.1	13.0	13
1981	447505	18	35430	8	6763	7	12.6	12.3	12
1982	550396	8	39146	5	7566	5	14.1	14.4	11
1983	413752	12	32085	7	6287	6	12.9	12.2	11
1984	478940	12	35196	9	7276	7	13.6	14.3	11
1985	612604	10	48823	7	9900	6	12.5	13.2	9
1986	348824	11	38201	8	7992	6	9.1	9.2	12
1987	367025	12	38475	8	7342	8	9.5	10.0	19
1988	772884	13	58874	7	12454	6	13.1	12.0	10

* CPUE1 = annual catch divided by annual boat hours
** CPUE2 = average of daily CPUE

Table 4

Creel Survey Pelagic Species Composition 1979-88

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Sharks	281	13724	1455	5303	6963	428	2087	1488	5534	6326
Mahimahi	68175	203136	27954	160200	128130	28847	92407	85393	86362	310032
Wahoo	25349	32825	82635	66416	89010	56501	159300	68830	82892	99801
Blue Marlin	33553	32192	40389	32465	30359	63057	77565	57682	73169	68511
Sailfish	0	1411	1272	1425	3820	952	915	1474	5913	1145
Blk. Marlin	0	2705	4909	1911	0	0	0	0	0	0
Spearfish	0	0	0	0	0	0	0	0	855	1957
Skipjack	56690	175542	158493	137735	85008	248243	137097	73199	59228	184838
Yellowfin	29171	49386	107828	137202	65598	71502	122707	47290	41754	77434
Dogtooth	113	758	12894	5624	1521	968	8488	4159	3706	5964
Kawakawa	332	0	544	880	499	1398	1972	9	1509	3497
Tunas (misc)	0	0	399	34	0	0	97	40	28	17

Table 5

GUAM 1979-88 ANNUAL COMMERCIAL LANDINGS OF PELAGIC SPECIES
EFFORT, SALES, AND REVENUE BY FISHING METHOD AND SPECIES

YEAR	FISHING METHOD	SPECIES	NUMBER TRIPS	WEIGHT (LBS)	REVENUE ($)	PRICE ($/LB)
1979	UNSPECIFIED	PMUS TOTAL	103	7259	8087	1.11
		MAHIMAHI	35	793	992	1.25
		WAHOO	66	3227	4049	1.25
		BILLFISH TOTAL	19	3239	3046	0.94
		SAILFISH	2	98	107	1.09
		MARLIN-UNSPECIFIED	17	3141	2939	0.94
		TUNAS TOTAL	125	8432	10099	1.20
		PMUS & TUNAS	176	15691	18186	1.16
		PELAGICS-MISC. TOTAL	49	2914	3643	1.25
		RAINBOW RUNNER	13	232	290	1.25
		MISC. TROLL FISH	38	2682	3353	1.25
		ALL PELAGICS	205	18605	21829	1.17
1980	UNSPECIFIED	PMUS TOTAL	576	51816	66609	1.29
		MAHIMAHI	332	26338	32968	1.25
		WAHOO	256	10631	15845	1.49
		BILLFISH TOTAL	112	14847	17796	1.20
		SAILFISH	5	262	328	1.25
		MARLIN-UNSPECIFIED	107	14585	17468	1.20
		TUNAS TOTAL	482	34707	42123	1.21
		PMUS & TUNAS	819	86523	108732	1.26
		PELAGICS-MISC. TOTAL	109	2185	3138	1.44
		RAINBOW RUNNER	31	523	683	1.31
		MISC. TROLL FISH	82	1662	2455	1.48
		ALL PELAGICS	837	88708	111870	1.26
1981	UNSPECIFIED	PMUS TOTAL	727	65446	90571	1.38
		MAHIMAHI	312	15540	23261	1.50
		WAHOO	466	27305	40933	1.50
		BILLFISH TOTAL	149	22222	26187	1.18
		SAILFISH	11	587	770	1.31
		MARLIN-UNSPECIFIED	138	21635	25417	1.17
		SHARKS	9	379	190	0.50
		TUNAS TOTAL	694	59833	77404	1.29
		PMUS & TUNAS	1048	125279	167975	1.34
		PELAGICS-MISC. TOTAL	225	4469	6734	1.51
		RAINBOW RUNNER	118	2256	3393	1.50
		MISC. TROLL FISH	128	2213	3341	1.51
		ALL PELAGICS	1089	129748	174709	1.35

Table 5 (Cont.)

YEAR	FISHING METHOD	SPECIES	NUMBER TRIPS	WEIGHT (LBS)	REVENUE ($)	PRICE ($/LB)
1982	UNSPECIFIED	PMUS TOTAL	526	50053	69093	1.38
		MAHIMAHI	367	30996	44569	1.44
		WAHOO	194	7582	11433	1.51
		BILLFISH TOTAL	71	10802	12750	1.18
		SAILFISH	3	161	201	1.25
		MARLIN-UNSPECIFIED	68	10641	12549	1.18
		SHARKS	16	673	341	0.51
		TUNAS TOTAL	387	39331	48720	1.24
		PMUS & TUNAS	694	89384	117813	1.32
		PELAGICS-MISC. TOTAL	106	2160	3303	1.53
		RAINBOW RUNNER	16	161	242	1.50
		MISC. TROLL FISH	93	1999	3061	1.53
		ALL PELAGICS	715	91544	121116	1.32
	TROLLING	PMUS TOTAL	174	13059	18354	1.41
		MAHIMAHI	81	3066	4659	1.52
		WAHOO	125	6706	9966	1.49
		BILLFISH TOTAL	21	3078	3624	1.18
		SAILFISH	1	84	104	1.25
		MARLIN-UNSPECIFIED	20	2994	3520	1.18
		SHARKS	6	209	105	0.50
		TUNAS TOTAL	218	23452	30341	1.29
		PMUS & TUNAS	272	36511	48695	1.33
		PELAGICS-MISC. TOTAL	46	839	1290	1.54
		RAINBOW RUNNER	18	234	353	1.51
		MISC. TROLL FISH	32	605	937	1.55
		ALL PELAGICS	273	37350	49985	1.34
	JIGGING	PMUS TOTAL	1	117	176	1.50
		WAHOO	1	117	176	1.50
		TUNAS TOTAL	2	495	695	1.40
		PMUS & TUNAS	2	612	871	1.42
		PELAGICS-MISC. TOTAL	1	11	16	1.50
		MISC. TROLL FISH	1	11	16	1.50
		ALL PELAGICS	2	623	887	1.42
1982	IKA SHIBI	PMUS TOTAL	1	66	46	0.69
		MAHIMAHI	1	13	19	1.50
		SHARKS	1	53	27	0.50
		TUNAS TOTAL	1	9	13	1.50
		PMUS & TUNAS	1	75	59	0.78
		PELAGICS-MISC. TOTAL	1	10	15	1.50
		MISC. TROLL FISH	1	10	15	1.50
		ALL PELAGICS	1	85	74	0.87
	LONGLINE-TUNA	PMUS TOTAL	1	48	24	0.50
		SHARKS	1	48	24	0.50
		TUNAS TOTAL	2	231	373	1.62
		PMUS & TUNAS	3	279	397	1.43
		ALL PELAGICS	3	279	397	1.43

Table 5 (Cont.)

YEAR	FISHING METHOD	SPECIES	NUMBER TRIPS	WEIGHT (LBS)	REVENUE ($)	PRICE ($/LB)
1982	BOTTOMFISH-SHALLOW	PMUS TOTAL	6	201	198	0.99
		MAHIMAHI	1	36	54	1.50
		WAHOO	3	65	94	1.45
		SHARKS	3	100	50	0.50
		TUNAS TOTAL	4	301	436	1.45
		PMUS & TUNAS	9	502	634	1.26
		PELAGICS-MISC. TOTAL	5	42	62	1.50
		RAINBOW RUNNER	1	4	5	1.50
		MISC. TROLL FISH	5	38	57	1.50
		ALL PELAGICS	10	544	696	1.28
	BOTTOMFISH-DEEP	PMUS TOTAL	2	66	51	0.78
		MAHIMAHI	1	8	12	1.50
		WAHOO	1	10	15	1.50
		SHARKS	1	48	24	0.50
		TUNAS TOTAL	1	31	31	1.00
		PMUS & TUNAS	3	97	82	0.85
		PELAGICS-MISC. TOTAL	1	24	35	1.50
		MISC. TROLL FISH	1	24	35	1.50
		ALL PELAGICS	3	121	117	0.98
	ALL GEARS	PMUS TOTAL	711	63610	87942	1.38
		MAHIMAHI	451	34119	49313	1.45
		WAHOO	324	14480	21684	1.50
		BILLFISH TOTAL	92	13880	16374	1.18
		SAILFISH	4	245	305	1.25
		MARLIN-UNSPECIFIED	88	13635	16069	1.18
		SHARKS	28	1131	571	0.50
		TUNAS TOTAL	615	63850	80609	1.26
		PMUS & TUNAS	984	127460	168551	1.32
		PELAGICS-MISC. TOTAL	160	3086	4721	1.53
		RAINBOW RUNNER	35	399	600	1.51
		MISC. TROLL FISH	133	2687	4121	1.53
		ALL PELAGICS	1007	130546	173272	1.33
1983	UNSPECIFIED	PMUS TOTAL	204	23759	32983	1.39
		MAHIMAHI	153	13694	18792	1.37
		WAHOO	110	8117	12202	1.50
		BILLFISH TOTAL	16	1702	1862	1.09
		SHORTBILL SPEARFISH	1	38	38	1.00
		SAILFISH	4	201	230	1.14
		MARLIN-UNSPECIFIED	13	1463	1594	1.09
		SHARKS	4	246	127	0.52
		TUNAS TOTAL	134	8066	9173	1.14
		PMUS & TUNAS	220	31825	42156	1.32
		PELAGICS-MISC. TOTAL	28	702	852	1.21
		RAINBOW RUNNER	8	141	189	1.34
		MISC. TROLL FISH	22	561	663	1.18
		ALL PELAGICS	224	32527	43008	1.32

Table 5 (Cont.)

YEAR	FISHING METHOD	SPECIES	NUMBER TRIPS	WEIGHT (LBS)	REVENUE ($)	PRICE ($/LB)
1983	TROLLING	PMUS TOTAL	1266	146010	200203	1.37
		MAHIMAHI	899	83756	116954	1.40
		WAHOO	629	41041	59535	1.45
		BILLFISH TOTAL	137	20103	23159	1.15
		SAILFISH	19	1225	1515	1.24
		MARLIN-UNSPECIFIED	119	18878	21644	1.15
		SHARKS	26	1110	555	0.50
		TUNAS TOTAL	891	66237	83309	1.26
		PMUS & TUNAS	1481	212247	283512	1.34
		PELAGICS-MISC. TOTAL	203	3565	4686	1.31
		RAINBOW RUNNER	70	963	1427	1.48
		MISC. TROLL FISH	148	2602	3259	1.25
		ALL PELAGICS	1492	215812	288198	1.34
	JIGGING	PMUS TOTAL	6	227	318	1.41
		MAHIMAHI	3	50	75	1.50
		WAHOO	5	159	234	1.48
		SHARKS	1	18	9	0.50
		TUNAS TOTAL	5	220	288	1.31
		PMUS & TUNAS	9	447	606	1.36
		PELAGICS-MISC. TOTAL	1	2	3	1.25
		MISC. TROLL FISH	1	2	3	1.25
		ALL PELAGICS	9	449	609	1.36
	IKA SHIBI	PMUS TOTAL	1	72	76	1.06
		WAHOO	1	40	60	1.50
		SHARKS	1	32	16	0.50
		TUNAS TOTAL	2	1599	2450	1.53
		PMUS & TUNAS	2	1671	2526	1.51
		ALL PELAGICS	2	1671	2526	1.51
	LONGLINE-TUNA	PMUS TOTAL	5	595	685	1.15
		MAHIMAHI	3	290	427	1.47
		WAHOO	1	22	32	1.50
		BILLFISH TOTAL	1	112	140	1.25
		MARLIN-UNSPECIFIED	1	112	140	1.25
		SHARKS	3	171	86	0.50
		TUNAS TOTAL	4	376	566	1.51
		PMUS & TUNAS	6	971	1251	1.29
		ALL PELAGICS	6	971	1251	1.29

Table 5 (Cont.)

YEAR	FISHING METHOD	SPECIES	NUMBER TRIPS	WEIGHT (LBS)	REVENUE ($)	PRICE ($/LB)
1983	BOTTOMFISH-SHALLOW	PMUS TOTAL	6	262	298	1.14
		MAHIMAHI	3	103	132	1.28
		WAHOO	1	15	19	1.25
		BILLFISH TOTAL	1	100	125	1.25
		MARLIN-UNSPECIFIED	1	100	125	1.25
		SHARKS	2	44	22	0.50
		TUNAS TOTAL	5	251	283	1.13
		PMUS & TUNAS	10	513	581	1.13
		PELAGICS-MISC. TOTAL	4	53	65	1.22
		RAINBOW RUNNER	2	6	9	1.50
		MISC. TROLL FISH	2	47	56	1.18
		ALL PELAGICS	11	566	646	1.14
	BOTTOMFISH-DEEP	PMUS TOTAL	18	1351	1644	1.22
		MAHIMAHI	11	527	741	1.41
		WAHOO	7	274	399	1.46
		BILLFISH TOTAL	3	336	397	1.18
		MARLIN-UNSPECIFIED	3	336	397	1.18
		SHARKS	6	214	107	0.50
		TUNAS TOTAL	22	2695	3555	1.32
		PMUS & TUNAS	30	4046	5199	1.29
		PELAGICS-MISC. TOTAL	14	324	435	1.34
		RAINBOW RUNNER	8	188	281	1.49
		MISC. TROLL FISH	10	136	154	1.13
		ALL PELAGICS	35	4370	5634	1.29
	SPEAR	PMUS TOTAL	3	133	195	1.47
		MAHIMAHI	3	133	195	1.47
		PMUS & TUNAS	3	133	195	1.47
		PELAGICS-MISC. TOTAL	1	8	9	1.25
		MISC. TROLL FISH	1	8	9	1.25
		ALL PELAGICS	4	141	204	1.46
	OTHER	PMUS TOTAL	2	102	134	1.31
		MAHIMAHI	1	88	127	1.44
		SHARKS	1	14	7	0.50
		PMUS & TUNAS	2	102	134	1.31
		ALL PELAGICS	2	102	134	1.31

Table 5 (Cont.)

YEAR	FISHING METHOD	SPECIES	NUMBER TRIPS	WEIGHT (LBS)	REVENUE ($)	PRICE ($/LB)
1983	ALL GEARS	PMUS TOTAL	1511	172511	236536	1.37
		MAHIMAHI	1076	98641	137443	1.39
		WAHOO	754	49668	72481	1.46
		BILLFISH TOTAL	158	22353	25683	1.15
		SHORTBILL SPEARFISH	1	38	38	1.00
		SAILFISH	23	1426	1745	1.22
		MARLIN-UNSPECIFIED	137	20889	23900	1.14
		SHARKS	44	1849	929	0.50
		TUNAS TOTAL	1063	79444	99624	1.25
		PMUS & TUNAS	1763	251955	336160	1.33
		PELAGICS-MISC. TOTAL	251	4654	6050	1.30
		RAINBOW RUNNER	88	1298	1906	1.47
		MISC. TROLL FISH	34	3356	4144	1.23
		ALL PELAGICS	1785	256609	342210	1.33
1984	UNSPECIFIED	PMUS TOTAL	259	27768	39415	1.42
		MAHIMAHI	181	12324	17443	1.42
		WAHOO	152	11479	17830	1.55
		BILLFISH TOTAL	23	3788	4024	1.06
		SHORTBILL SPEARFISH	1	20	20	1.00
		SAILFISH	1	20	25	1.25
		MARLIN-UNSPECIFIED	21	3748	3979	1.06
		SHARKS	6	177	118	0.67
		TUNAS TOTAL	304	29164	34027	1.17
		PMUS & TUNAS	390	56932	73442	1.29
		PELAGICS-MISC. TOTAL	66	1395	1921	1.38
		RAINBOW RUNNER	19	226	317	1.40
		MISC. TROLL FISH	57	1169	1604	1.37
		ALL PELAGICS	399	58327	75363	1.29
	TROLLING	PMUS TOTAL	696	64210	92148	1.44
		MAHIMAHI	211	7981	13571	1.70
		WAHOO	493	29490	51691	1.75
		BILLFISH TOTAL	166	26544	26793	1.01
		SAILFISH	8	407	542	1.33
		MARLIN-UNSPECIFIED	160	26137	26251	1.00
		SHARKS	6	195	93	0.48
		TUNAS TOTAL	695	70520	86166	1.22
		PMUS & TUNAS	1028	134730	178314	1.32
		PELAGICS-MISC. TOTAL	165	2043	2755	1.35
		RAINBOW RUNNER	44	358	535	1.49
		MISC. TROLL FISH	136	1685	2220	1.32
		ALL PELAGICS	1034	136773	181069	1.32
	JIGGING	PMUS TOTAL	1	58	29	0.50
		SHARKS	1	58	29	0.50
		TUNAS TOTAL	9	420	596	1.42
		PMUS & TUNAS	9	478	625	1.31
		PELAGICS-MISC. TOTAL	21	286	361	1.26
		MISC. TROLL FISH	21	286	361	1.26
		ALL PELAGICS	27	764	986	1.29

Table 5 (Cont.)

YEAR	FISHING METHOD	SPECIES	NUMBER TRIPS	WEIGHT (LBS)	REVENUE ($)	PRICE ($/LB)
1984	BOTTOMFISH-SHALLOW	PMUS TOTAL	2	63	51	0.82
		SHARKS	2	63	51	0.82
		TUNAS TOTAL	2	24	32	1.32
		PMUS & TUNAS	4	87	83	0.96
		PELAGICS-MISC. TOTAL	5	58	73	1.28
		MISC. TROLL FISH	5	58	73	1.28
		ALL PELAGICS	8	145	156	1.09
	BOTTOMFISH-DEEP	PMUS TOTAL	1	29	14	0.50
		SHARKS	1	29	14	0.50
		TUNAS TOTAL	5	97	124	1.27
		PMUS & TUNAS	6	126	138	1.10
		ALL PELAGICS	6	126	138	1.10
	SPEAR	PMUS TOTAL	2	31	47	1.50
		MAHIMAHI	2	31	47	1.50
		TUNAS TOTAL	1	6	9	1.50
		PMUS & TUNAS	3	37	56	1.50
		PELAGICS-MISC. TOTAL	2	28	35	1.25
		MISC. TROLL FISH	2	28	35	1.25
		ALL PELAGICS	5	65	91	1.39
	NET	TUNAS TOTAL	2	19	25	1.32
		PMUS & TUNAS	2	19	25	1.32
		PELAGICS-MISC. TOTAL	1	9	11	1.25
		MISC. TROLL FISH	1	9	11	1.25
		ALL PELAGICS	3	28	36	1.30
	ALL GEARS	PMUS TOTAL	958	92159	131704	1.43
		MAHIMAHI	394	20336	31061	1.53
		WAHOO	645	40969	69521	1.70
		BILLFISH TOTAL	189	30332	30817	1.02
		SHORTBILL SPEARFISH	1	20	20	1.00
		SAILFISH	9	427	567	1.33
		MARLIN-UNSPECIFIED	181	29885	30230	1.01
		SHARKS	16	522	305	0.59
		TUNAS TOTAL	1018	100250	120979	1.21
		PMUS & TUNAS	1439	192409	252683	1.31
		PELAGICS-MISC. TOTAL	260	3819	5156	1.35
		RAINBOW RUNNER	63	584	852	1.46
		MISC. TROLL FISH	222	3235	4304	1.33
		ALL PELAGICS	1479	196228	257839	1.31

Table 5 (Cont.)

YEAR	FISHING METHOD	SPECIES	NUMBER TRIPS	WEIGHT (LBS)	REVENUE ($)	PRICE ($/LB)
1985	UNSPECIFIED	PMUS TOTAL	70	7204	12227	1.70
		MAHIMAHI	58	4918	8153	1.66
		WAHOO	38	2053	3783	1.84
		BILLFISH TOTAL	2	233	291	1.25
		MARLIN-UNSPECIFIED	2	233	291	1.25
		TUNAS TOTAL	47	2055	2650	1.29
		PMUS & TUNAS	82	9259	14877	1.61
		PELAGICS-MISC. TOTAL	12	118	171	1.44
		RAINBOW RUNNER	1	5	8	1.50
		MISC. TROLL FISH	12	113	163	1.44
		ALL PELAGICS	82	9377	15048	1.60
	TROLLING	PMUS TOTAL	1244	124110	206992	1.67
		MAHIMAHI	591	40627	76361	1.88
		WAHOO	953	62700	112085	1.79
		BILLFISH TOTAL	120	20683	18460	0.89
		SHORTBILL SPEARFISH	2	44	61	1.38
		SAILFISH	7	355	406	1.15
		MARLIN-UNSPECIFIED	111	20284	17993	0.89
		SHARKS	2	100	86	0.86
		TUNAS TOTAL	944	74659	106384	1.42
		PMUS & TUNAS	1560	198769	313376	1.58
		PELAGICS-MISC. TOTAL	259	4546	6252	1.38
		RAINBOW RUNNER	69	805	1239	1.54
		MISC. TROLL FISH	204	3741	5013	1.34
		ALL PELAGICS	1581	203315	319628	1.57
	JIGGING	TUNAS TOTAL	2	12	18	1.47
		PMUS & TUNAS	2	12	18	1.47
		PELAGICS-MISC. TOTAL	14	196	262	1.34
		MISC. TROLL FISH	14	196	262	1.34
		ALL PELAGICS	15	208	280	1.35
	BOTTOMFISH-SHALLOW	PMUS TOTAL	4	92	180	1.97
		MAHIMAHI	1	17	33	2.00
		WAHOO	2	54	108	2.00
		BILLFISH TOTAL	1	21	39	1.85
		MARLIN-UNSPECIFIED	1	21	39	1.85
		TUNAS TOTAL	4	129	142	1.10
		PMUS & TUNAS	7	221	322	1.46
		PELAGICS-MISC. TOTAL	6	104	146	1.40
		MISC. TROLL FISH	6	104	146	1.40
		ALL PELAGICS	13	325	468	1.44

Table 5 (Cont.)

YEAR	FISHING METHOD	SPECIES	NUMBER TRIPS	WEIGHT (LBS)	REVENUE ($)	PRICE ($/LB)
1985	BOTTOMFISH-DEEP	PMUS TOTAL	2	137	55	0.40
		SHARKS	2	137	55	0.40
		TUNAS TOTAL	2	60	103	1.72
		PMUS & TUNAS	4	197	158	0.80
		PELAGICS-MISC. TOTAL	2	21	27	1.33
		RAINBOW RUNNER	1	7	10	1.50
		MISC. TROLL FISH	1	14	17	1.25
		ALL PELAGICS	6	218	185	0.85
	SPEAR	PMUS TOTAL	10	460	850	1.85
		MAHIMAHI	5	227	421	1.86
		WAHOO	7	233	429	1.84
		TUNAS TOTAL	7	58	87	1.50
		PMUS & TUNAS	16	518	937	1.81
		PELAGICS-MISC. TOTAL	4	48	68	1.42
		MISC. TROLL FISH	4	48	68	1.42
		ALL PELAGICS	20	566	1005	1.78
	NET	PMUS TOTAL	1	40	74	1.85
		MAHIMAHI	1	40	74	1.85
		TUNAS TOTAL	1	118	166	1.41
		PMUS & TUNAS	2	158	240	1.52
		ALL PELAGICS	2	158	240	1.52
	OTHER	TUNAS TOTAL	1	15	23	1.50
		PMUS & TUNAS	1	15	23	1.50
		ALL PELAGICS	1	15	23	1.50
1985	ALL GEARS	PMUS TOTAL	1329	132043	220378	1.67
		MAHIMAHI	656	45829	85042	1.86
		WAHOO	1000	65040	116405	1.79
		BILLFISH TOTAL	123	20937	18790	0.90
		SHORTBILL SPEARFISH	2	44	61	1.38
		SAILFISH	7	355	406	1.15
		MARLIN-UNSPECIFIED	114	20538	18323	0.89
		SHARKS	4	237	141	0.59
		TUNAS TOTAL	1008	77106	109573	1.42
		PMUS & TUNAS	1672	209149	329951	1.58
		PELAGICS-MISC. TOTAL	297	5033	6926	1.38
		RAINBOW RUNNER	71	817	1257	1.54
		MISC. TROLL FISH	241	4216	5669	1.34
		ALL PELAGICS	1718	214182	336877	1.57
1986	UNSPECIFIED	PMUS TOTAL	5	441	668	1.52
		MAHIMAHI	4	355	512	1.44
		WAHOO	3	86	156	1.82
		TUNAS TOTAL	2	84	97	1.16
		PMUS & TUNAS	6	525	765	1.46
		PELAGICS-MISC. TOTAL	1	27	41	1.50
		MISC. TROLL FISH	1	27	41	1.50
		ALL PELAGICS	6	552	806	1.46

Table 5 (Cont.)

YEAR	FISHING METHOD	SPECIES	NUMBER TRIPS	WEIGHT (LBS)	REVENUE ($)	PRICE ($/LB)
1986	TROLLING	PMUS TOTAL	1304	140821	212922	1.51
		MAHIMAHI	781	62715	100809	1.61
		WAHOO	693	38894	75405	1.94
		BILLFISH TOTAL	266	38890	36538	0.94
		SHORTBILL SPEARFISH	1	23	29	1.25
		SAILFISH	18	960	1359	1.42
		MARLIN-UNSPECIFIED	249	37907	35150	0.93
		SHARKS	5	322	170	0.53
		TUNAS TOTAL	916	56853	80024	1.41
		PMUS & TUNAS	1654	197674	292946	1.48
		PELAGICS-MISC. TOTAL	231	4449	6521	1.47
		RAINBOW RUNNER	50	743	1111	1.50
		MISC. TROLL FISH	195	3706	5410	1.46
		ALL PELAGICS	1675	202123	299467	1.48
	JIGGING	PMUS TOTAL	1	30	38	1.25
		MAHIMAHI	1	30	38	1.25
		PMUS & TUNAS	1	30	38	1.25
		PELAGICS-MISC. TOTAL	1	23	34	1.50
		MISC. TROLL FISH	1	23	34	1.50
		ALL PELAGICS	2	53	72	1.36
	BOTTOMFISH-SHALLOW	PMUS TOTAL	3	167	276	1.65
		MAHIMAHI	2	110	198	1.80
		WAHOO	1	33	66	2.00
		SHARKS	1	24	12	0.50
		TUNAS TOTAL	3	292	463	1.59
		PMUS & TUNAS	5	459	739	1.61
		PELAGICS-MISC. TOTAL	2	144	217	1.50
		RAINBOW RUNNER	1	135	203	1.50
		MISC. TROLL FISH	1	9	14	1.50
		ALL PELAGICS	6	603	956	1.58
1986	BOTTOMFISH-DEEP	PMUS TOTAL	1	112	0	0.00
		SHARKS	1	112	0	0.00
		PMUS & TUNAS	1	112	0	0.00
		ALL PELAGICS	1	112	0	0.00
	SPEAR	PMUS TOTAL	2	36	40	1.11
		SHARKS	2	36	40	1.11
		TUNAS TOTAL	2	14	21	1.50
		PMUS & TUNAS	4	50	61	1.22
		ALL PELAGICS	4	50	61	1.22
	NET	PMUS TOTAL	1	34	47	1.37
		MAHIMAHI	1	34	47	1.37
		PMUS & TUNAS	1	34	47	1.37
		ALL PELAGICS	1	34	47	1.37

Table 5 (Cont.)

YEAR	FISHING METHOD	SPECIES	NUMBER TRIPS	WEIGHT (LBS)	REVENUE ($)	PRICE ($/LB)
1986	ALL GEARS	PMUS TOTAL	1314	141641	213991	1.51
		MAHIMAHI	789	63244	101604	1.61
		WAHOO	697	39013	75627	1.94
		BILLFISH TOTAL	266	38890	36538	0.94
		SHORTBILL SPEARFISH	1	23	29	1.25
		SAILFISH	18	960	1359	1.42
		MARLIN-UNSPECIFIED	249	37907	35150	0.93
		SHARKS	9	494	222	0.45
		TUNAS TOTAL	923	57243	80605	1.41
		PMUS & TUNAS	1669	198884	294596	1.48
		PELAGICS-MISC. TOTAL	235	4643	6813	1.47
		RAINBOW RUNNER	51	878	1314	1.50
		MISC. TROLL FISH	198	3765	5499	1.46
		ALL PELAGICS	1692	203527	301409	1.48
1987	UNSPECIFIED	PMUS TOTAL	36	2313	2842	1.23
		MAHIMAHI	18	715	1233	1.72
		WAHOO	17	572	950	1.66
		BILLFISH TOTAL	5	898	595	0.66
		MARLIN-UNSPECIFIED	5	898	595	0.66
		SHARKS	4	128	64	0.50
		TUNAS TOTAL	32	2282	3203	1.40
		PMUS & TUNAS	53	4595	6045	1.32
		PELAGICS-MISC. TOTAL	19	349	439	1.26
		RAINBOW RUNNER	1	7	10	1.50
		MISC. TROLL FISH	19	342	429	1.26
		ALL PELAGICS	62	4944	6484	1.31
	TROLLING	PMUS TOTAL	1304	126409	181679	1.44
		MAHIMAHI	726	46095	73263	1.59
		WAHOO	803	44612	77939	1.75
		BILLFISH TOTAL	210	35036	30144	0.86
		SAILFISH	18	1248	1221	0.98
		MARLIN-UNSPECIFIED	195	33788	28923	0.86
		SHARKS	12	666	333	0.50
		TUNAS TOTAL	757	56568	84417	1.49
		PMUS & TUNAS	1547	182977	266096	1.45
		PELAGICS-MISC. TOTAL	210	3828	5215	1.36
		RAINBOW RUNNER	40	504	762	1.51
		MISC. TROLL FISH	187	3324	4453	1.34
		ALL PELAGICS	1564	186805	271311	1.45
	JIGGING	PMUS TOTAL	1	26	13	0.50
		SHARKS	1	26	13	0.50
		PMUS & TUNAS	1	26	13	0.50
		PELAGICS-MISC. TOTAL	6	275	344	1.25
		MISC. TROLL FISH	6	275	344	1.25
		ALL PELAGICS	6	301	357	1.19

Table 5 (Cont.)

YEAR	FISHING METHOD	SPECIES	NUMBER TRIPS	WEIGHT (LBS)	REVENUE ($)	PRICE ($/LB)
1987	LONGLINE-TUNA	PMUS TOTAL	1	328	328	1.00
		WAHOO	1	328	328	1.00
		TUNAS TOTAL	1	377	377	1.00
		PMUS & TUNAS	1	705	705	1.00
		ALL PELAGICS	1	705	705	1.00
	BOTTOMFISH-SHALLOW	PMUS TOTAL	2	76	70	0.92
		MAHIMAHI	1	32	48	1.50
		SHARKS	1	44	22	0.50
		TUNAS TOTAL	1	13	13	1.00
		PMUS & TUNAS	3	89	83	0.94
		ALL PELAGICS	3	89	83	0.94
	BOTTOMFISH-DEEP	PMUS TOTAL	1	161	197	1.23
		MAHIMAHI	1	45	67	1.50
		WAHOO	1	21	35	1.70
		BILLFISH TOTAL	1	95	95	1.00
		MARLIN-UNSPECIFIED	1	95	95	1.00
		TUNAS TOTAL	4	282	312	1.11
		PMUS & TUNAS	4	443	509	1.15
		ALL PELAGICS	4	443	509	1.15
	SPEAR	TUNAS TOTAL	2	15	20	1.33
		PMUS & TUNAS	2	15	20	1.33
		PELAGICS-MISC. TOTAL	3	23	31	1.38
		MISC. TROLL FISH	3	23	31	1.38
		ALL PELAGICS	5	38	51	1.36
	OTHER	PMUS TOTAL	1	17	34	2.00
		WAHOO	1	17	34	2.00
		TUNAS TOTAL	3	588	1094	1.86
		PMUS & TUNAS	3	605	1128	1.86
		PELAGICS-MISC. TOTAL	2	31	38	1.25
		MISC. TROLL FISH	2	31	38	1.25
		ALL PELAGICS	4	636	1166	1.83
	ALL GEARS	PMUS TOTAL	1344	129330	185163	1.43
		MAHIMAHI	745	46887	74611	1.59
		WAHOO	823	45550	79286	1.74
		BILLFISH TOTAL	216	36029	30834	0.86
		SAILFISH	18	1248	1221	0.98
		MARLIN-UNSPECIFIED	201	34781	29613	0.85
		SHARKS	18	864	432	0.50
		TUNAS TOTAL	800	60125	89436	1.49
		PMUS & TUNAS	1612	189455	274599	1.45
		PELAGICS-MISC. TOTAL	240	4506	6067	1.35
		RAINBOW RUNNER	41	511	772	1.51
		MISC. TROLL FISH	217	3995	5295	1.33
		ALL PELAGICS	1647	193961	280666	1.45

Table 5 (Cont.)

YEAR	FISHING METHOD	SPECIES	NUMBER TRIPS	WEIGHT (LBS)	REVENUE ($)	PRICE ($/LB)
1988	UNSPECIFIED	PMUS TOTAL	1	19	24	1.25
		SHARKS	1	19	24	1.25
		PMUS & TUNAS	1	19	24	1.25
		ALL PELAGICS	1	19	24	1.25
	TROLLING	PMUS TOTAL	1273	92229	128163	1.39
		MAHIMAHI	773	47161	66741	1.42
		WAHOO	583	25080	44095	1.76
		BILLFISH TOTAL	137	19988	17327	0.87
		SAILFISH	15	1317	1332	1.01
		MARLIN-UNSPECIFIED	124	18671	15995	0.86
		TUNAS TOTAL	788	45983	60254	1.31
		PMUS & TUNAS	1569	138212	188417	1.36
		PELAGICS-MISC. TOTAL	166	3397	4785	1.41
		RAINBOW RUNNER	99	1977	2857	1.45
		MISC. TROLL FISH	84	1420	1928	1.36
		ALL PELAGICS	1590	141609	193202	1.36
	SPEAR	PELAGICS-MISC. TOTAL	2	6	8	1.50
		RAINBOW RUNNER	2	6	8	1.50
		ALL PELAGICS	2	6	8	1.50
	ALL GEARS	PMUS TOTAL	1274	92248	128187	1.39
		MAHIMAHI	773	47161	66741	1.42
		WAHOO	583	25080	44095	1.76
		BILLFISH TOTAL	137	19988	17327	0.87
		SAILFISH	15	1317	1332	1.01
		MARLIN-UNSPECIFIED	124	18671	15995	0.86
		SHARKS	1	19	24	1.25
		TUNAS TOTAL	788	45983	60254	1.31
		PMUS & TUNAS	1569	138231	188441	1.36
		PELAGICS-MISC. TOTAL	168	3403	4793	1.41
		RAINBOW RUNNER	101	1983	2865	1.45
		MISC. TROLL FISH	84	1420	1928	1.36
		ALL PELAGICS	1592	141634	193234	1.36

APPENDIX B: FIGURES

Figure 1

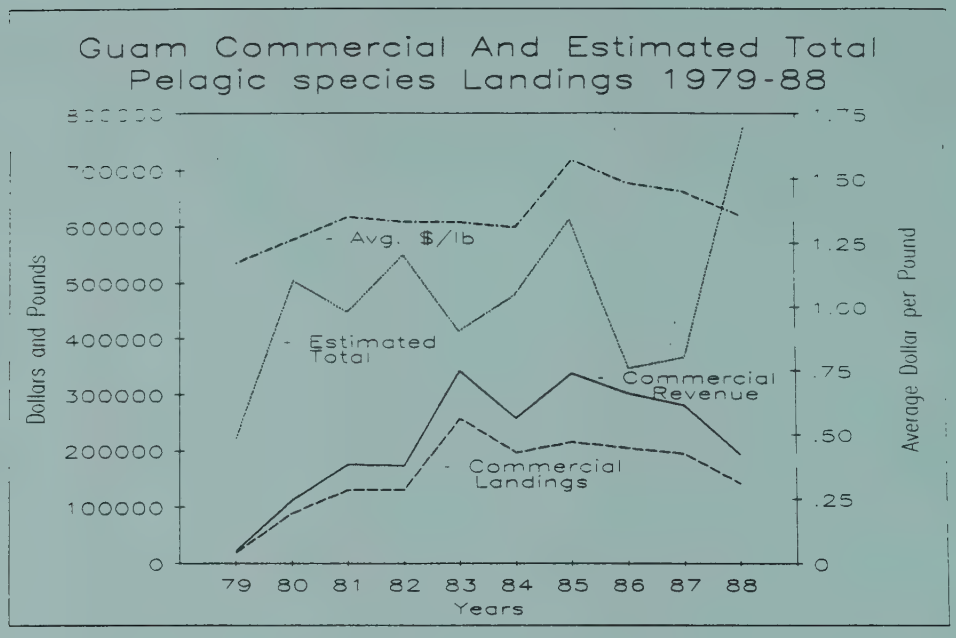


Figure 2

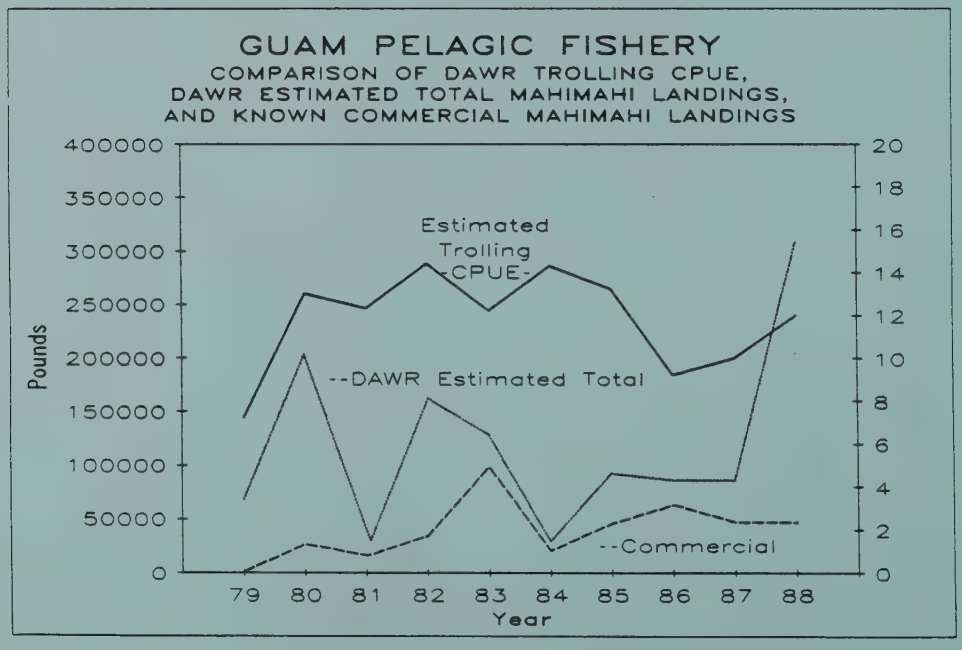


Figure 3

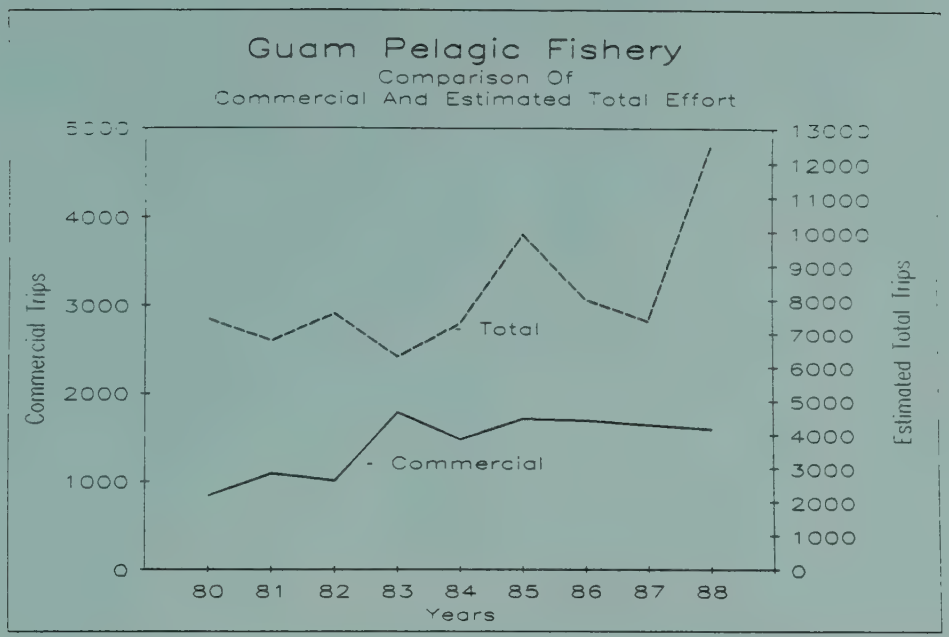


Figure 4

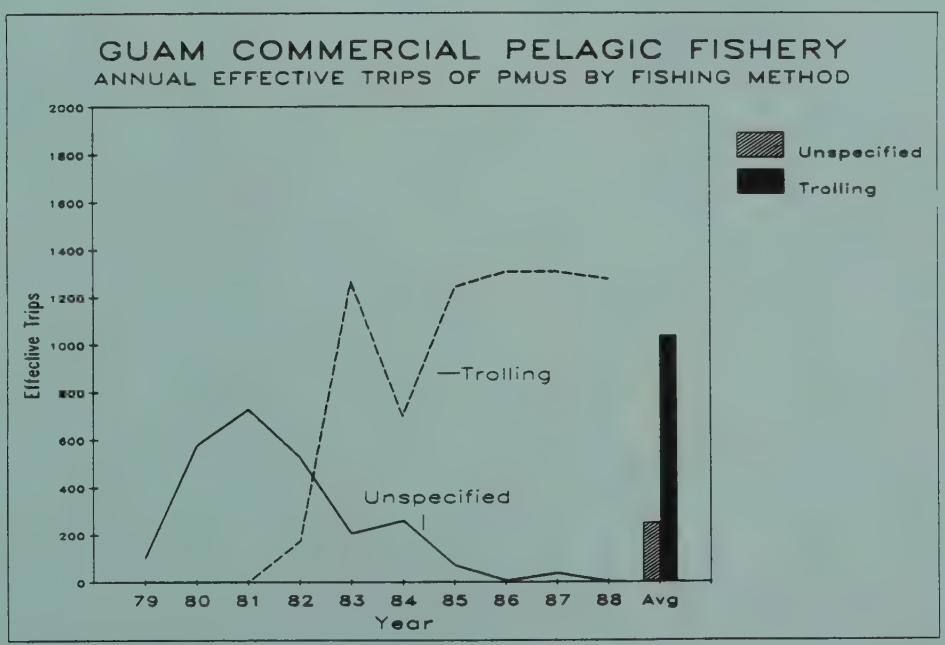


Figure 5

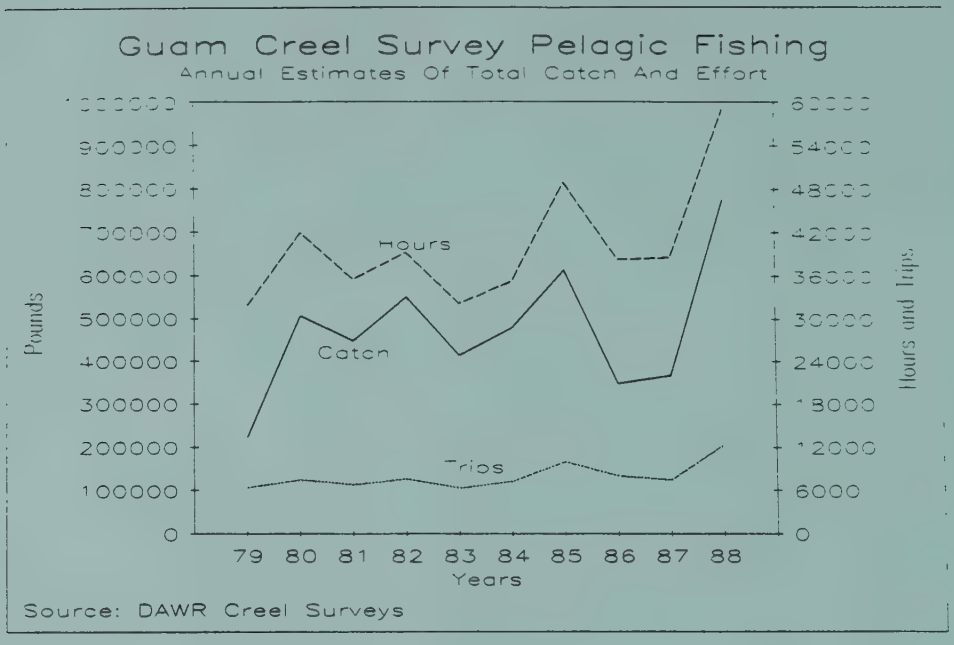


Figure 6

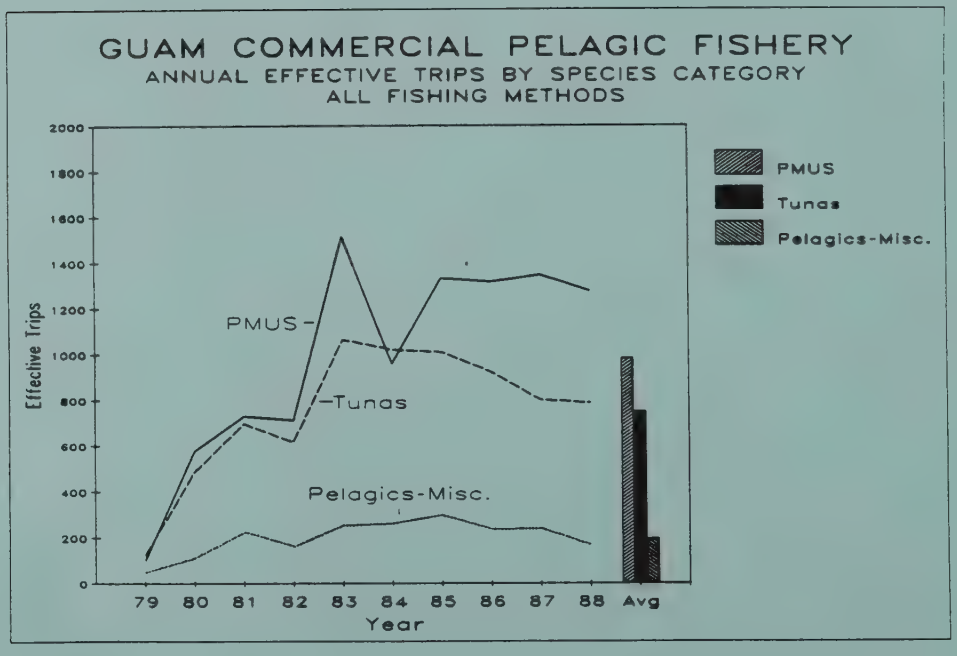
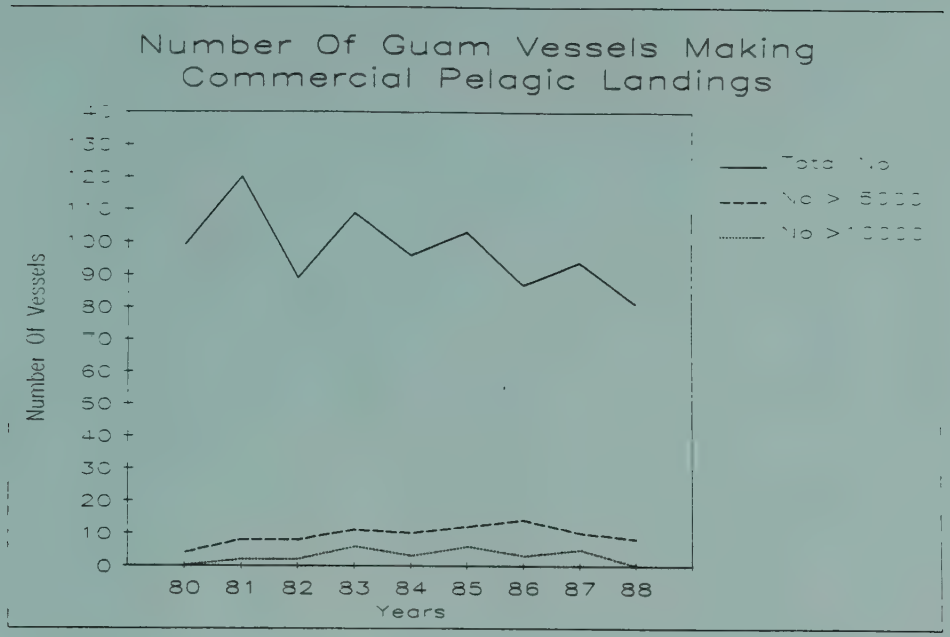


Figure 7



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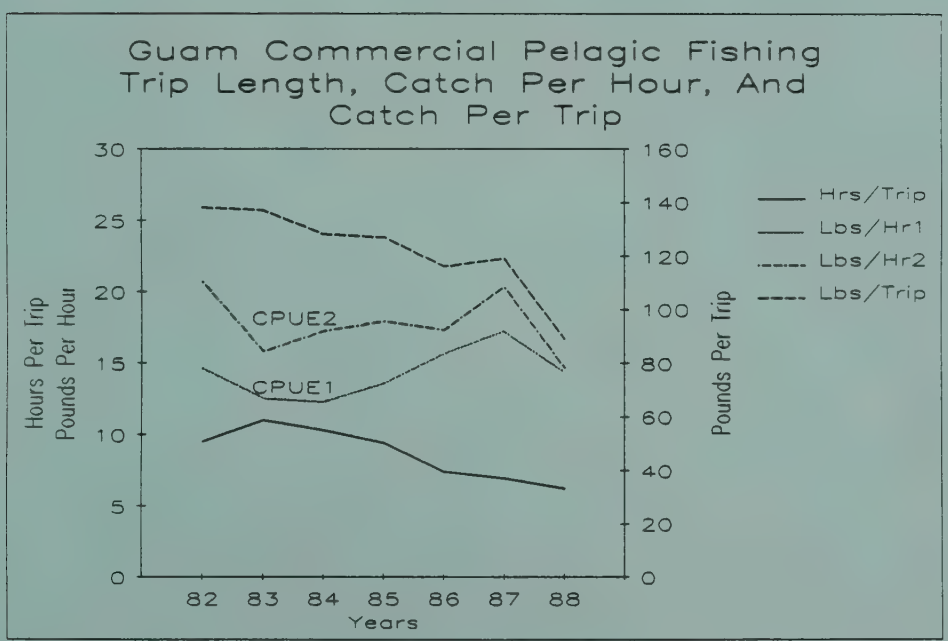

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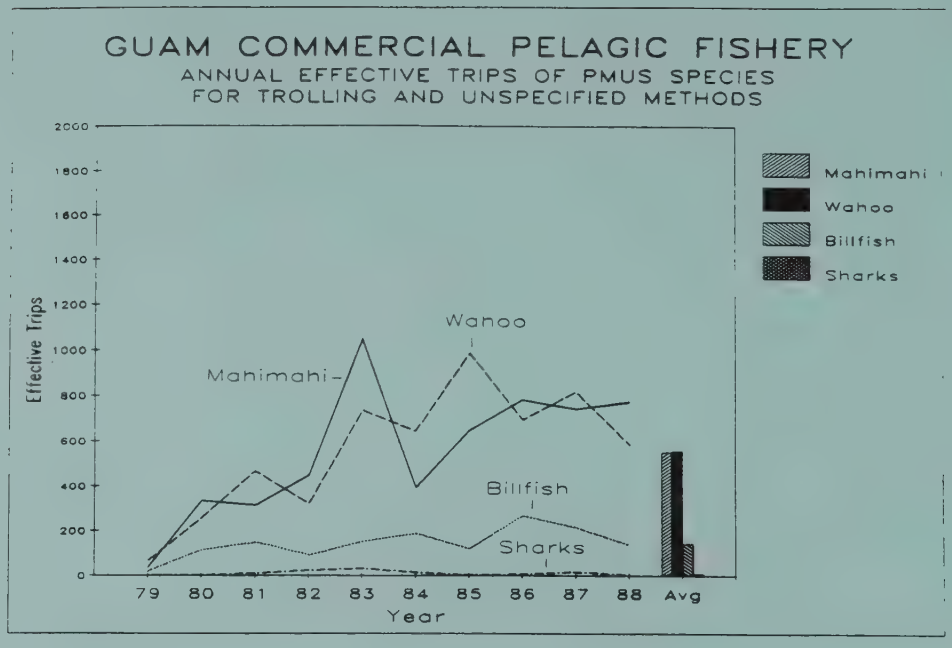
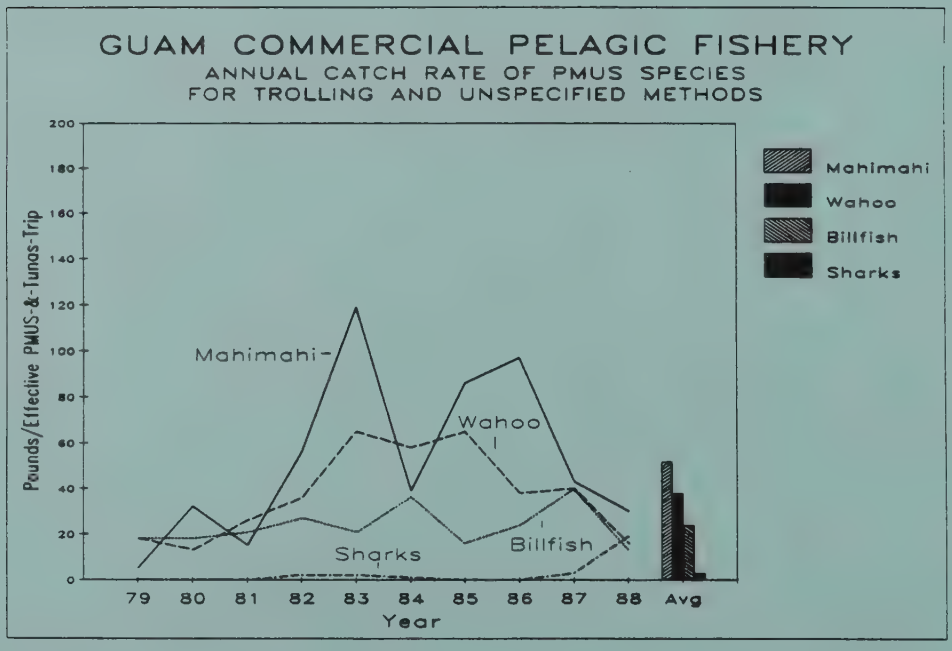


Figure 10



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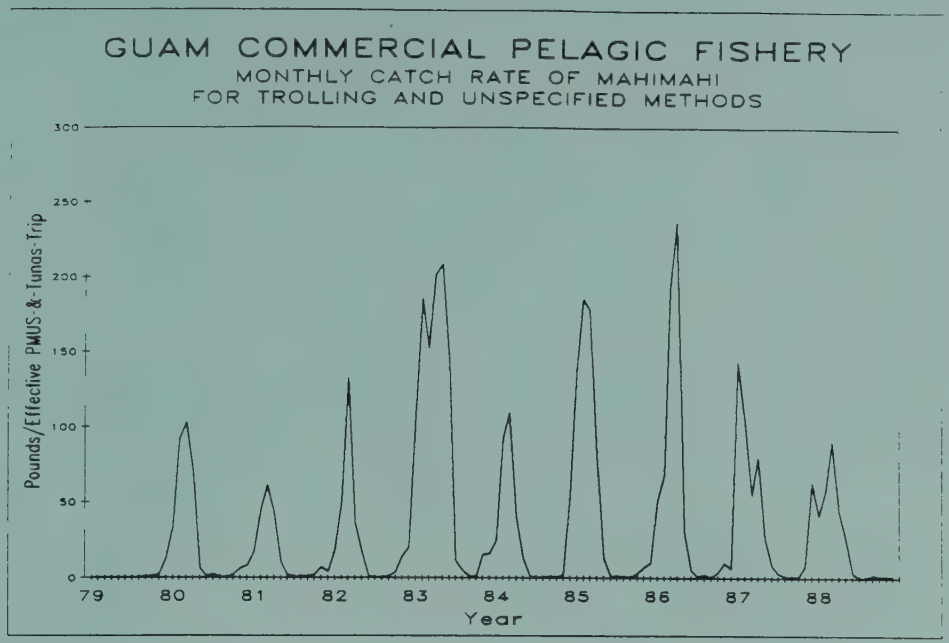

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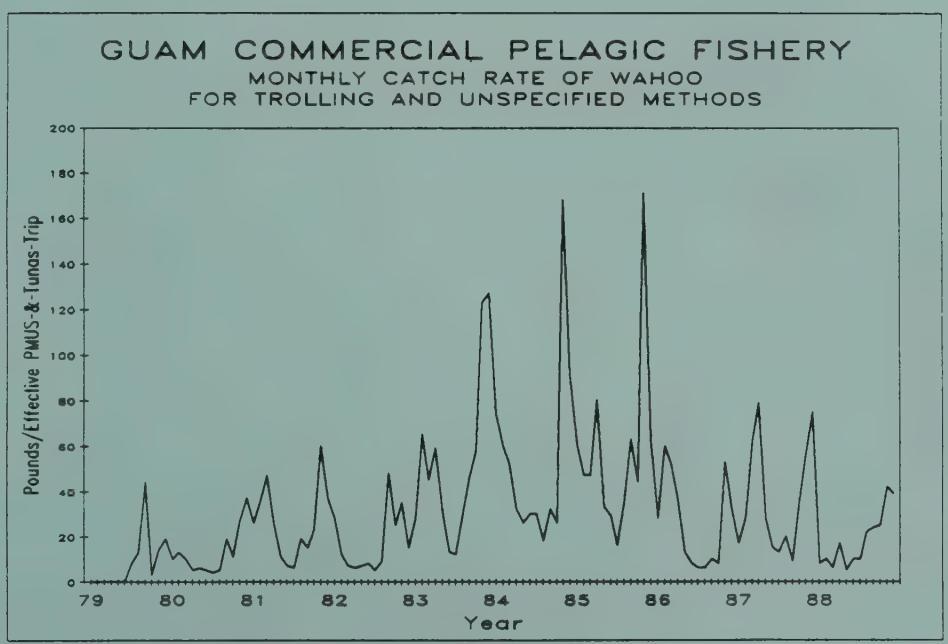

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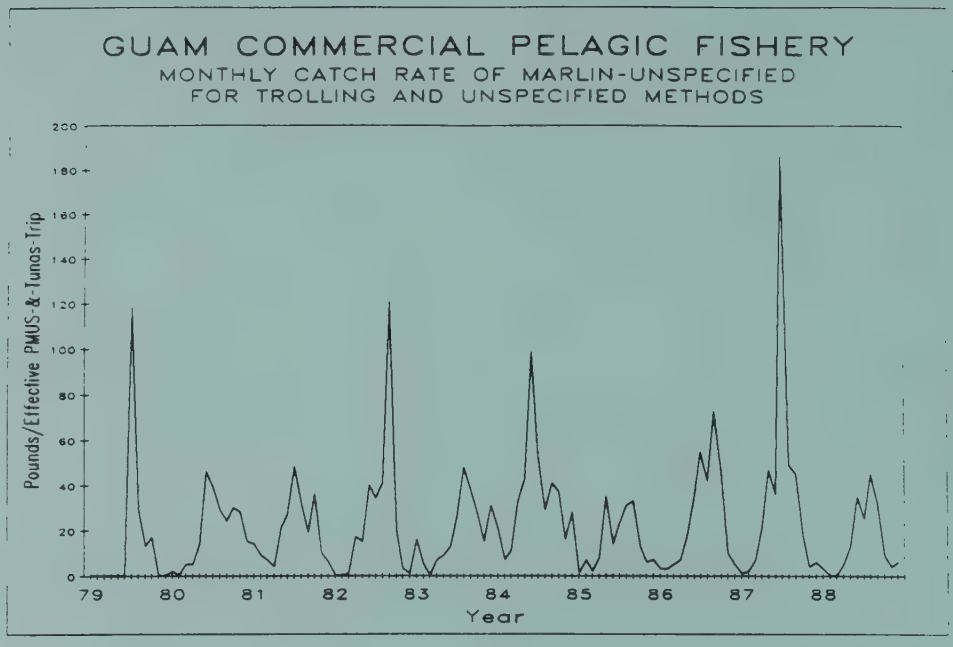
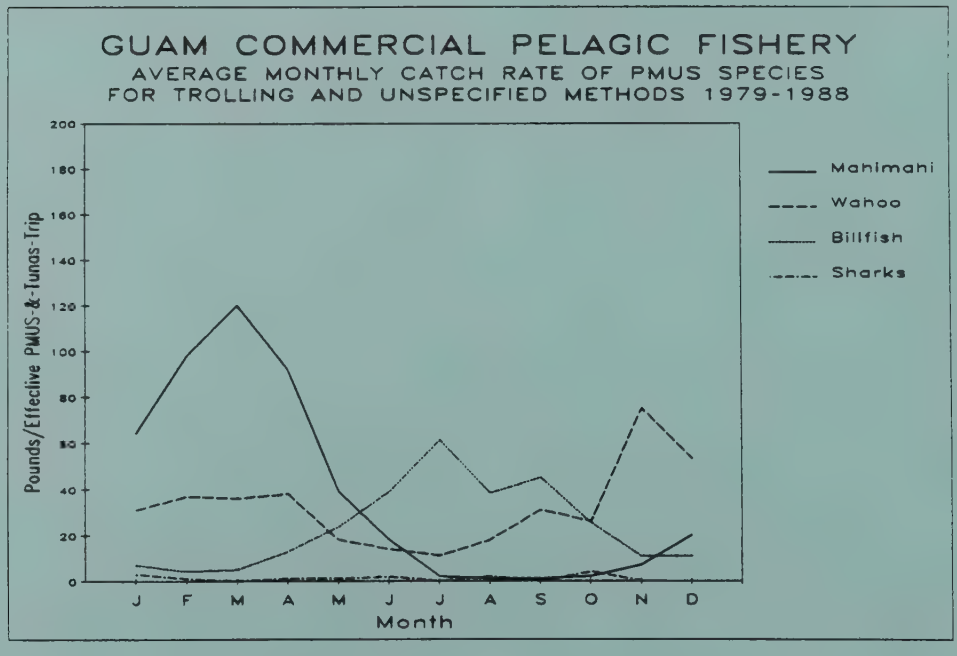


Figure 14



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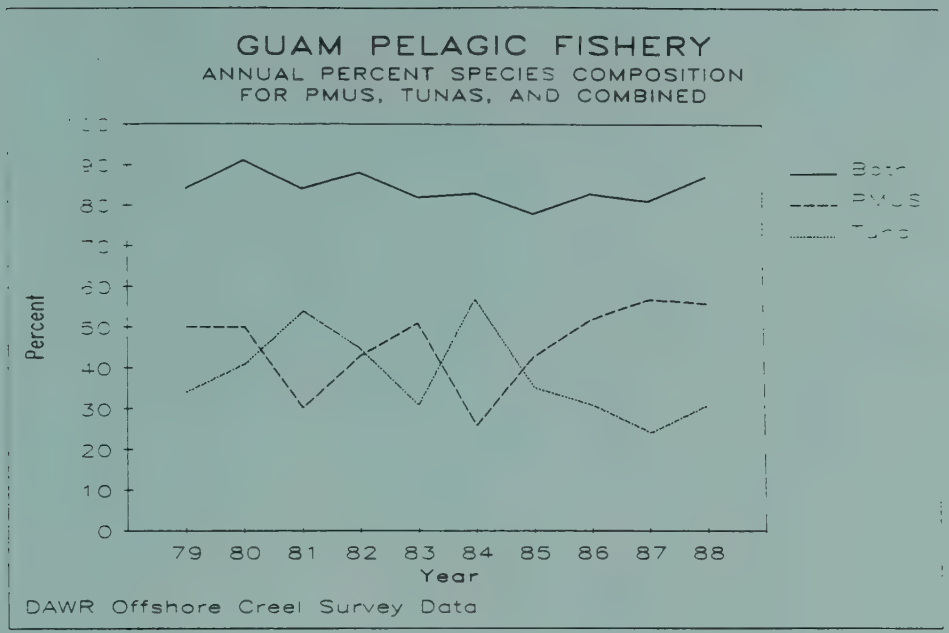

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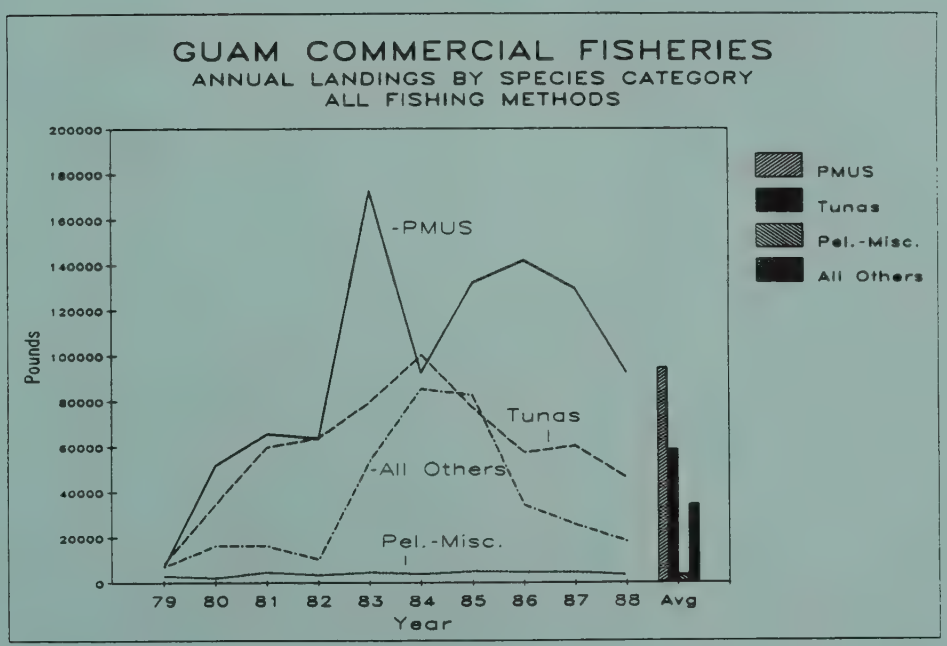

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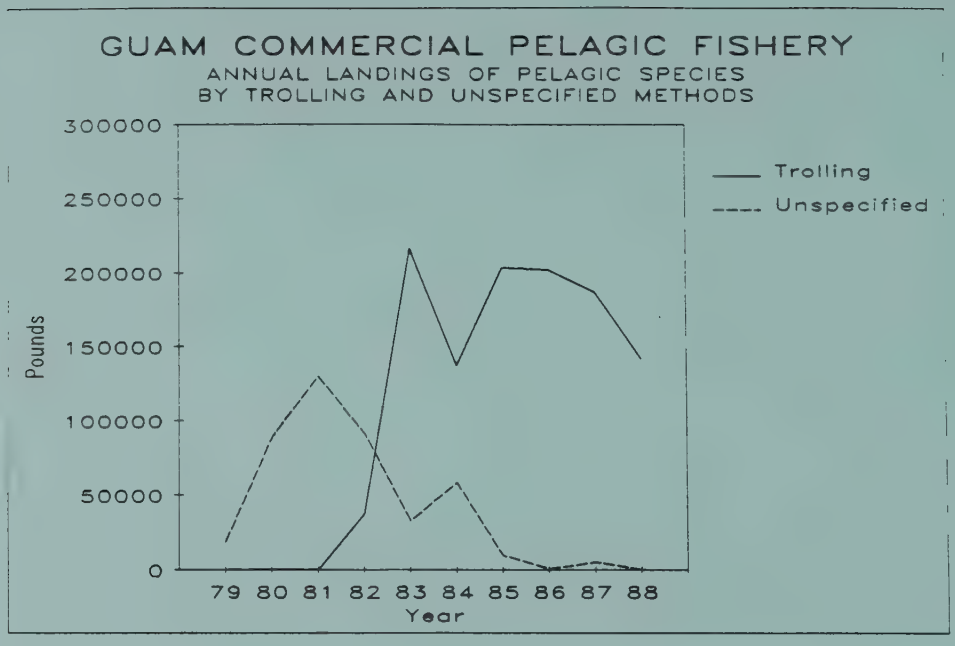

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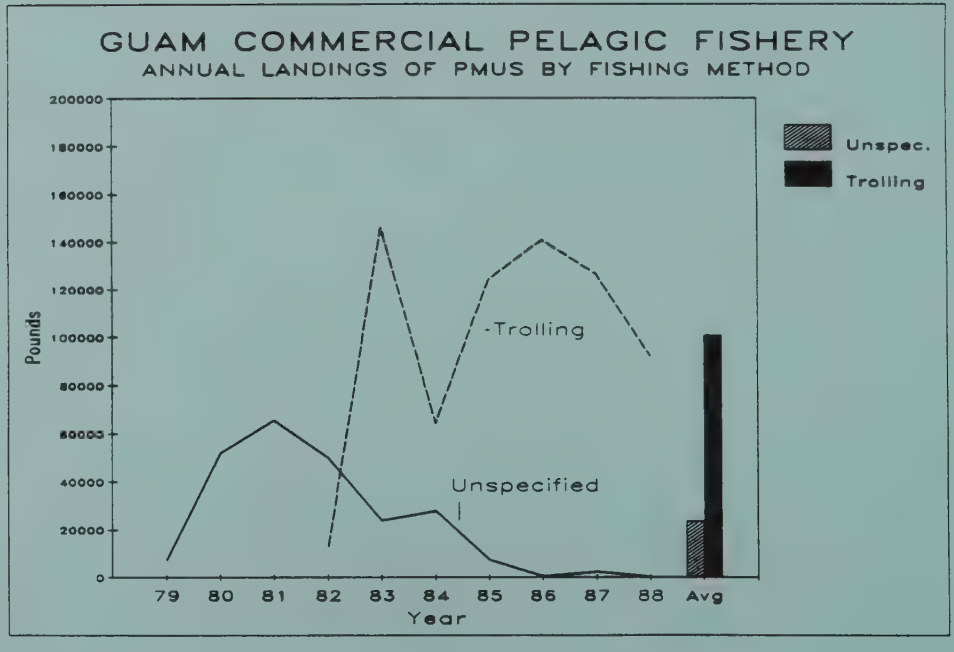

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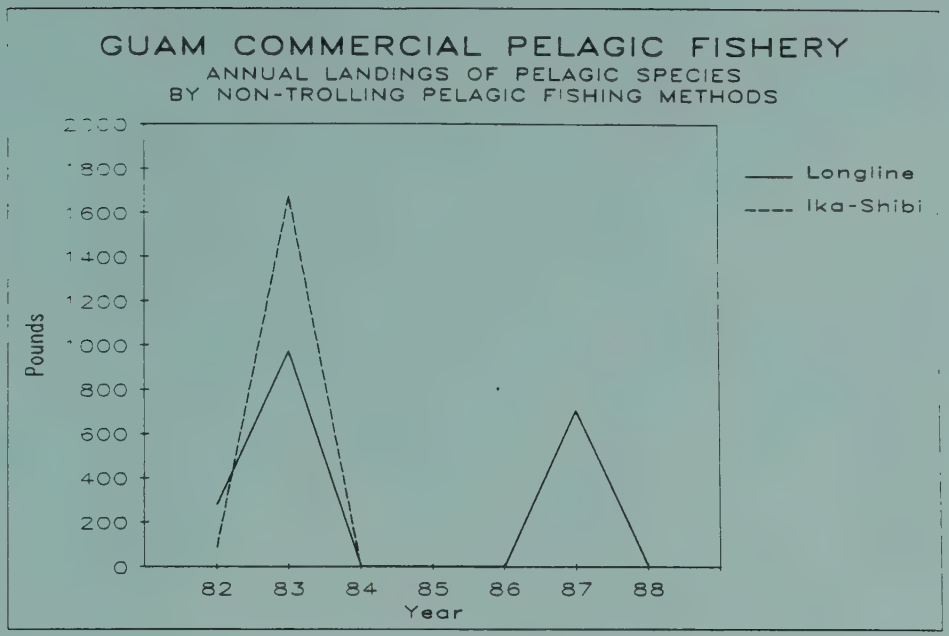

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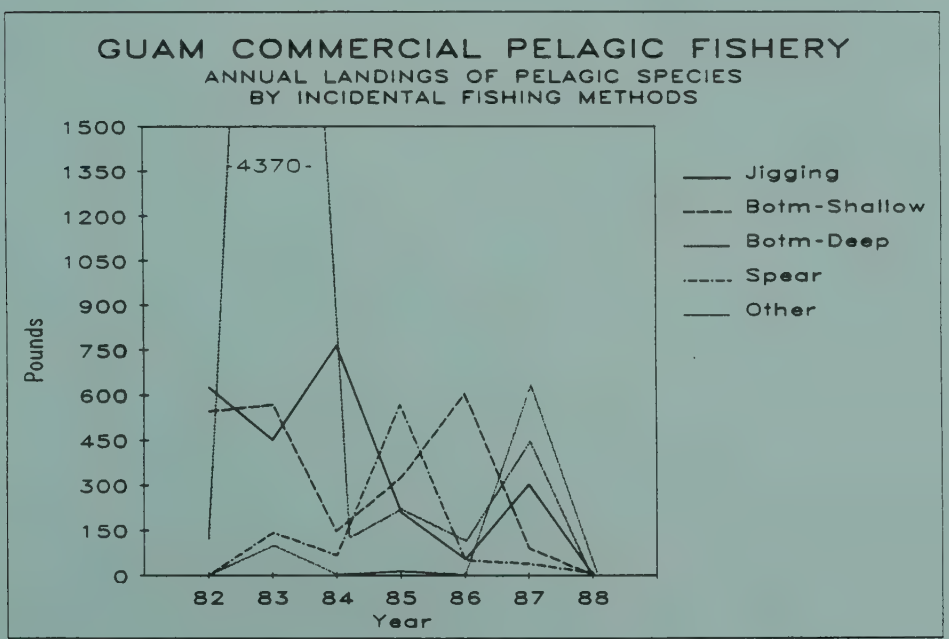

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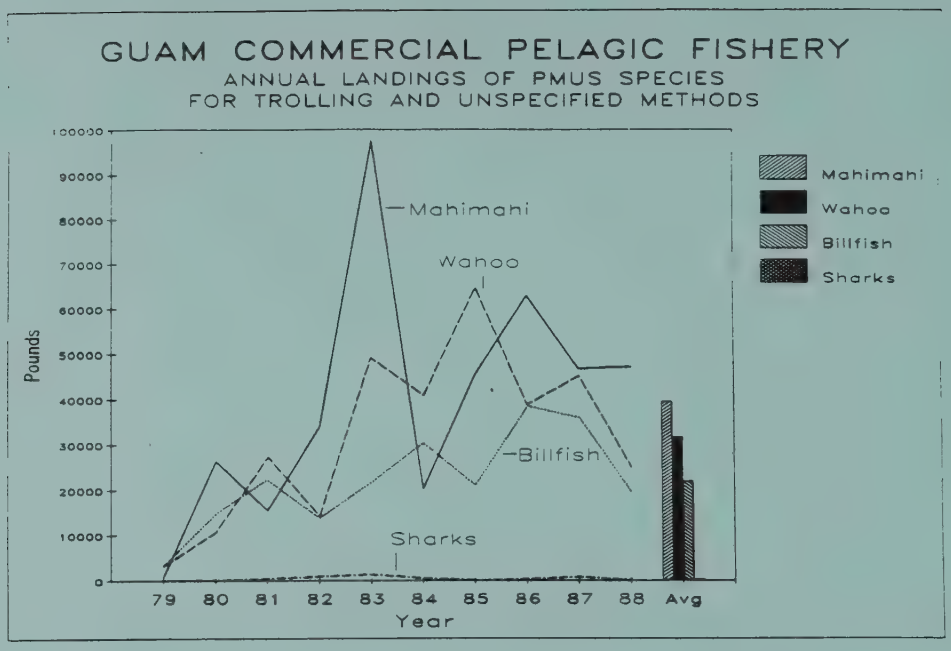

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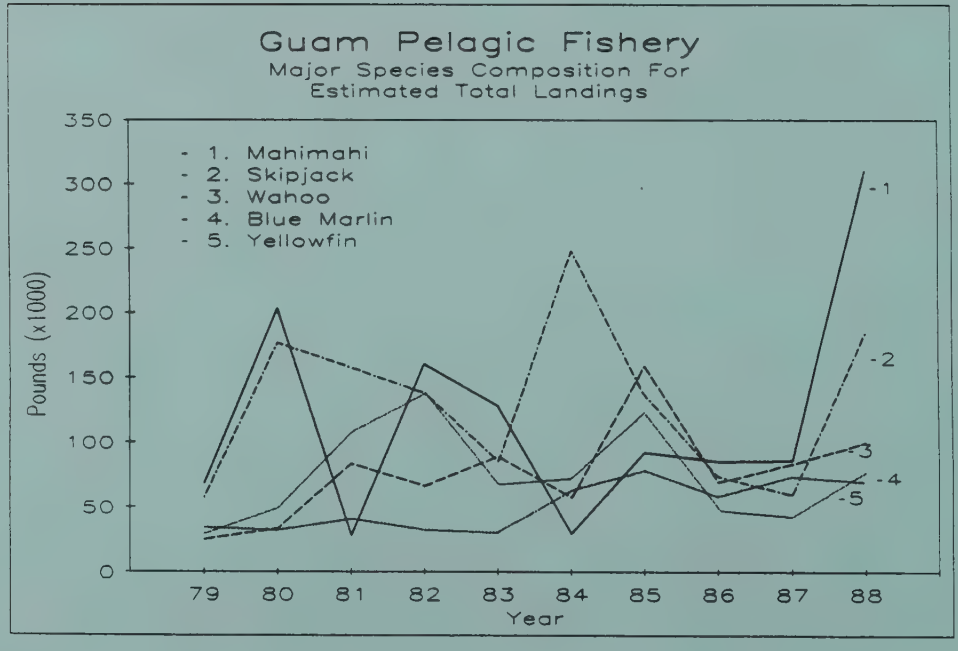


Figure 23

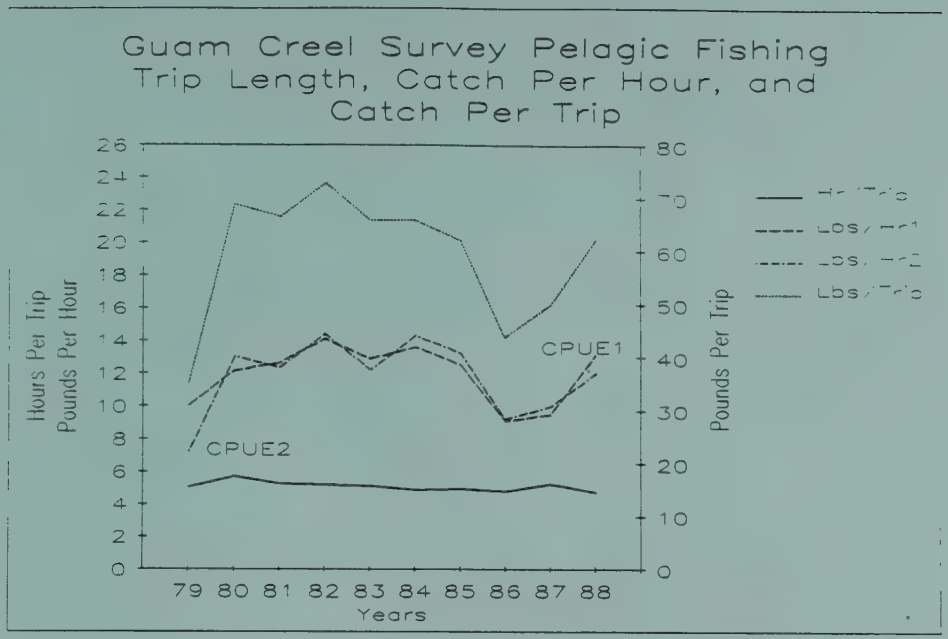

Guam Creel Survey Pelagic Fishing
Trip Length, Catch Per Hour, and
Catch Per Trip
Hours Per Trip
Pounds Per Hour
Pounds Per Trip
CPUE1
CPUE2
Years
79 80 81 82 83 84 85 86 87 88
0 2 4 6 8 10 12 14 16 18 20 22 24 26
0 10 20 30 40 50 60 70 80

Figure 24

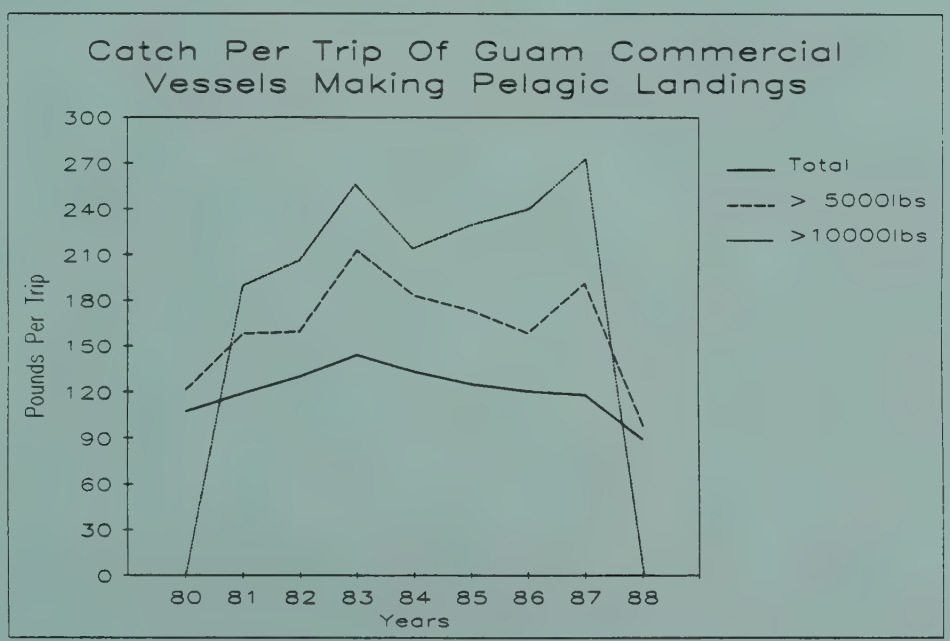

Catch Per Trip Of Guam Commercial
Vessels Making Pelagic Landings
Pounds Per Trip
Years
Total
> 5000lbs
>10000lbs
80 81 82 83 84 85 86 87 88
0 30 60 90 120 150 180 210 240 270 300

Figure 25

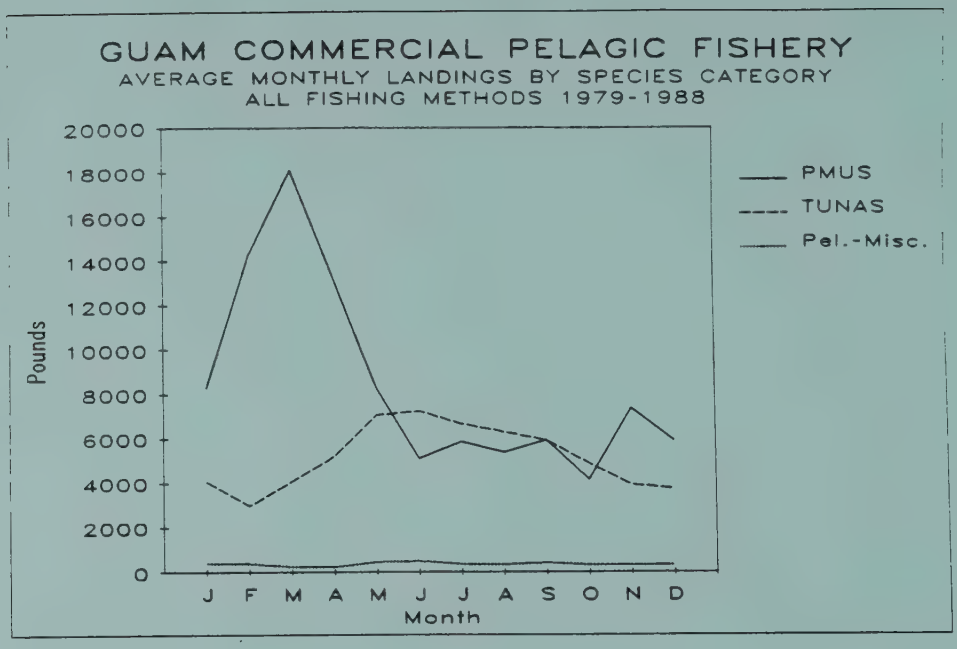
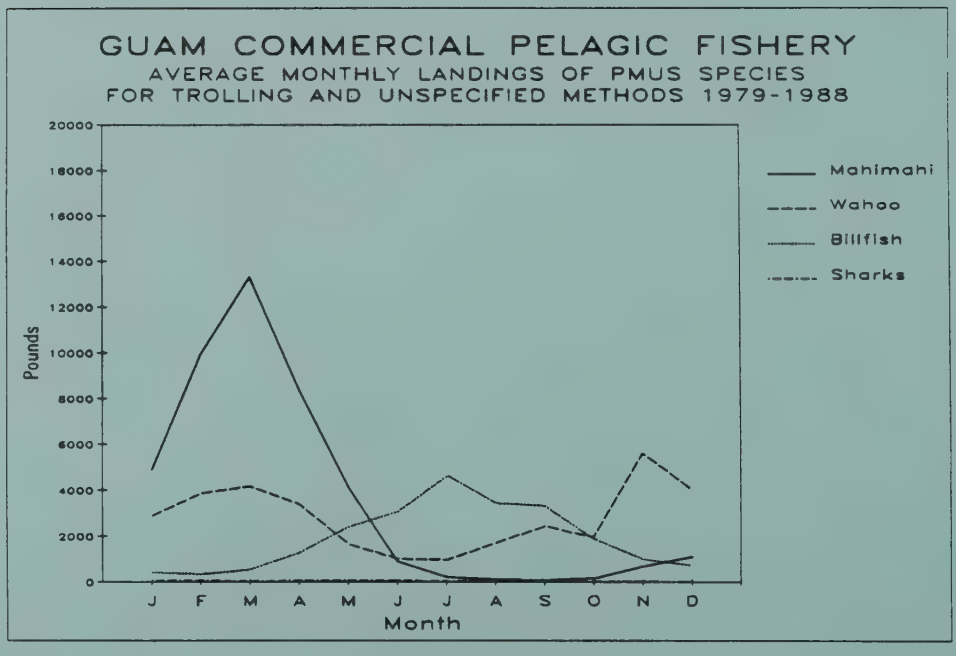


Figure 26



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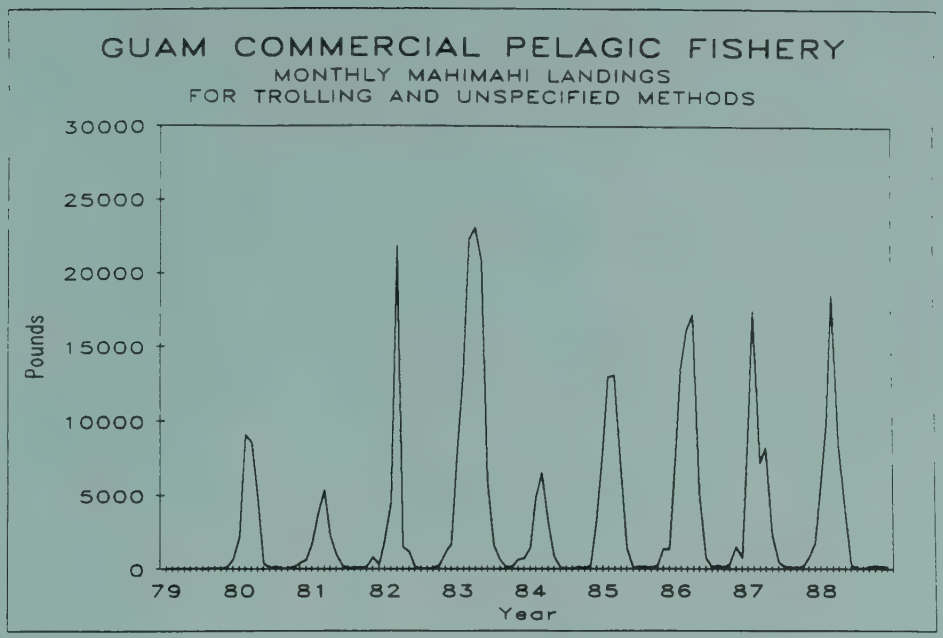

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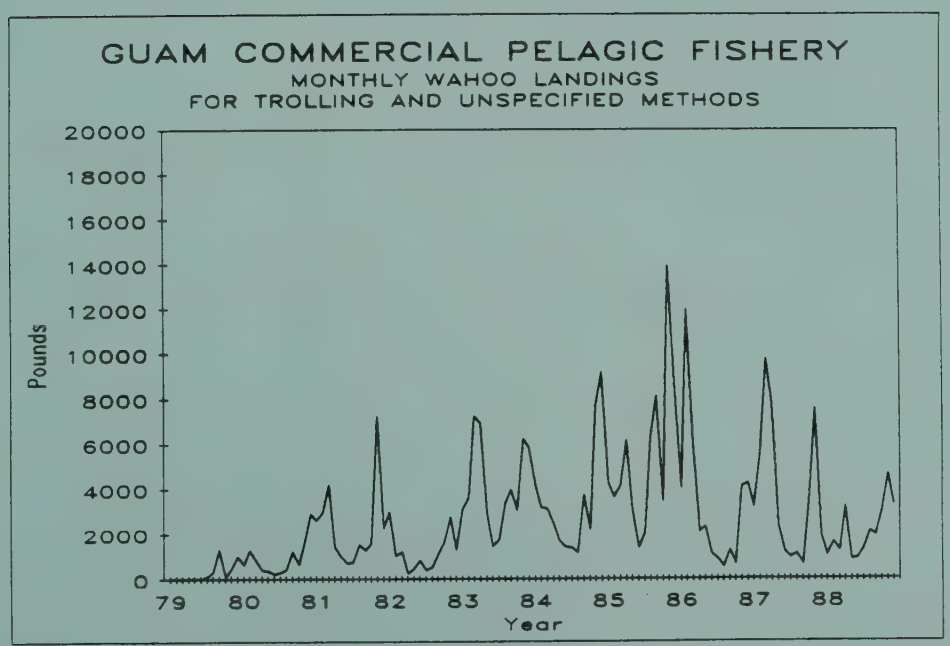
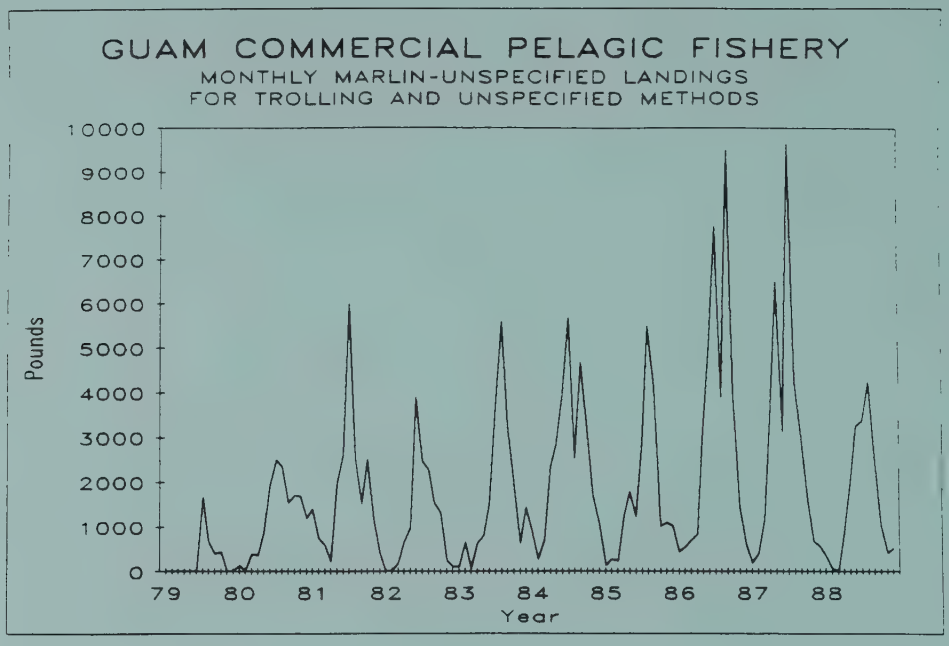


Figure 29


GUAM COMMERCIAL PELAGIC FISHERY
MONTHLY MARLIN-UNSPECIFIED LANDINGS
FOR TROLLING AND UNSPECIFIED METHODS
Pounds
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
79
80
81
82
83
84
85
86
87
88
Year

NORTHERN MARIANA ISLANDS FISHERY MODULE

ANNUAL REPORT FOR THE 1988 PELAGIC FISHERIES OF THE COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS

JUNE 1989

PREPARED BY

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Reese Tokunaga
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Division of Fish and Wildlife
Commonwealth of the Northern Mariana Islands

FOR THE

Western Pacific Regional Fishery Management Council's

PELAGIC PLAN MONITORING TEAM

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INTRODUCTION

The Fishery Management Plan (FMP) for the Pelagic Fisheries of the Western Pacific Region was implemented by the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA Fisheries) in 1987. The Western Pacific Regional Fishery Management Council (Council) developed the FMP to manage the pelagic resources occurring in its area of jurisdiction as defined in the Magnuson Fishery Management and Conservation Act of 1976. The management goal of the Pelagic FMP is to maintain pelagic stocks at optimal population levels while managing foreign fishing; promoting equitable domestic utilization of the resources by commercial, subsistence, and recreational sectors; eliminating waste from incidental harvest; and diminishing the risk of gear conflicts.

The pelagic management unit species (PMUS) covered by this FMP are given below.

Common Name	Scientific Name
Mahimahi (dolphinfish)	Coryphaena hippurus
Pompano dolphinfish	C. equiselis
Wahoo	Acanthocybium solandri
Indo-Pacific blue marlin	Makaira mazara
Black marlin	M. indica
Striped marlin	Tetrapturus audax
Shortbill spearfish	T. angustirostris
Swordfish	Xiphias gladius
Requiem sharks	Carcharhinidae
Thresher sharks	Alopiidae
Hammerhead sharks	Sphyrnidae
Mackerel sharks	Lamnidae

The Pelagic FMP required the Council to establish a Pelagic Plan Monitoring Team (Team) to prepare an annual report on the status of the pelagic fisheries for each of the island areas served by the Council. The Team decided to adopt a modular approach to developing the annual report, whereby each island area would develop an individual report for its pelagic fishery and would submit the report to the Team for review. This report module is submitted to the Team on behalf of the Commonwealth of the Northern Mariana Islands' (CNMI) Division of Fish and Wildlife (DFW) to help the Team determine the effectiveness of the FMP in meeting its goal in the CNMI.

Preparation of this report was a cooperative effort among staff of NOAA Fisheries Honolulu Laboratory's Western Pacific Fishery Information Network (WPACFIN), a contractor of the Council, and a newly appointed Team member from DFW. Some of the tables and figures were prepared by the contractor using computer programs developed specifically for the Council for that purpose; other data summaries, tables, and figures were prepared by WPACFIN staff using ad-hoc programs and data base queries. All data used in this report were collected by DFW staff. The DFW is upgrading its computer processing capabilities to enable its new

team member to complete all processing for writing future reports. The WPACFIN is assisting DFW meet this goal. This annual report module on the pelagic fisheries of the CNMI was prepared through cooperative efforts of the agencies involved and is the official submission of the DFW to the Team for the 1988 calendar year.

FISHERY PERFORMANCE DATA

The CNMI commercial pelagic fishery operates mainly around the most populated islands of Saipan, Rota, and Tinian. The fishery is conducted primarily with small outboard-powered boats making almost exclusively 1-day trolling trips. A few inboard-powered boats larger than 25 feet occasionally take multiple-day trips. The DFW has been collecting fishery statistics on the commercial fishing fleet located on Saipan since 1976 by collecting data at points of sale. The data collection system was improved substantially after 1982, and data from the early years are not comparable to those collected after 1982. Only data since 1979 are presented in this report, and caution is advised when interpreting trends in the fishery for the early years. Because of misleading fishing effort data in the 1979-82 span, some graphs include only data since 1983. Additionally, no information on method of catch is collected, although it is known that trolling is the method used almost exclusively by CNMI fishermen to catch pelagic species. The DFW has a creel survey sampling program designed to make estimates of total landings, whether sold or not, but those data are not included in this report.

Commercial fishery performance data are summarized in Tables 1 and 2 and Figures 1-17 in Appendices A and B, respectively. Although tuna species are not covered by the FMP, they are included in various tables and figures because they are, by far, the most important pelagic fishery resource harvested in the CNMI. Commercial harvesting of shark species is essentially non-existent. Annual summaries for years prior to 1988 have been included in this report because species subtotals not provided in the first annual PMT report have been added to the tables. For brevity, tables of monthly statistics are not included in this report, but are available for review at the Honolulu Laboratory. For additional background information on DFW's data collecting systems, assumptions and analyses used to summarize data in this report, the pelagic fishery, or specifics on other CNMI fisheries, refer to the Team's other annual reports, volumes of WPACFIN's "Fishery Statistics of the Western Pacific" (Hamm and Kassman 1986, Hamm and Quach 1988, 1989). Comments on the data summarized in the tables and figures of this report are provided under the following subsections as identified in the FMP.

1. Total Catch, Foreign and Domestic, by Species and Gear

No licensed foreign fishing under the FMP has taken place since the plan came into effect; hence, there are no foreign data to summarize. Total domestic "catch" data are not available,

only "landings," which are reported below.

2. Total Landings and Estimated Revenues by Species and Gear

Domestic commercial landings of pelagic species in 1988 equaled 267,619 pounds, which nearly reached the peak year of 1984, despite fewer trips than that year. The value of these landings, $327,260, surpassed all previous years (Figure 1). The PMUS landings reached an all-time high in 1988 (Figure 2), because mahimahi landings were the largest on record (Figure 3).

3. Fishing Effort

Fishing effort was estimated in terms of the effective number of trips in which each pelagic species or species group was landed. An effective trip for a particular species (or species category) is defined as a fishing trip resulting in the landing of said species (or species category). The total number of effective pelagic trips increased in 1988 (Figure 1), as did the number of trips for the PMUS group (Figure 4), primarily because of the substantial mahimahi season (Figure 5). However, trips landing wahoo and billfish declined in 1988 (Figure 5).

4. Annual and Quarterly Catch Rate by Species and Gear

Catch rate is calculated by dividing the landed weight of a species (or species category) by the number of trips resulting in a landing of any of the pelagic species, including tunas. Quarterly catch rates are not provided; however, annual, monthly, and average monthly catch rates are summarized in Figures 6, 7-9, and 10, respectively. The annual catch rate of mahimahi increased in 1988, whereas the annual catch rate for wahoo and billfish decreased slightly (Figure 6). As expected, catch rates were highest during the peak seasons for each species.

5. Relationships Among Fishery Sectors

5.1 Species Categories

Annual landings of PMUS have been relatively low and exceed only those of the miscellaneous pelagics category (Figure 2). In contrast, annual landings of tuna and the all others category have been substantially higher. On average, species category rankings are tunas, all others (primarily reef fish), PMUS, and miscellaneous pelagics.

5.2 Fishing Methods

Fishing method is not determined from the purchasers of fish and is not recorded; however, it is known that trolling is the only method capturing significant quantities of PMUS in the CNMI.

5.3 Fishery Stability

A total of 289 fishermen (boats) have landed pelagic species commercially since 1979. The annual number of fishermen landing pelagic species commercially has been fairly stable since 1983, as has the number of fishermen landing over 5,000 and over 10,000 pounds of pelagic fishes annually (Figure 11). The percent of the total landings of pelagic species made by the major fishermen has also remained fairly constant since 1983 (Figure 12). An average of 12 fishermen landed over 5,000 pounds of pelagic species each year and were responsible for about 75% of the total commercial pelagic landings. Of these, the top six fishermen typically landed over half of the total pelagic catch.

6. Species Composition

On average, the rank of species contributing to the landings of PMUS is mahimahi, wahoo, billfish, and sharks (Figure 3). While annual mahimahi landings generally exceed those of wahoo, average landings of wahoo on occasion rank first. Billfish landings have been low while shark landings are insignificant. Species composition seems to be fairly stable in the fishery, but no statistical analyses have been performed on the data to confirm this apparent stability.

7. Trends

7.1 Landings

No obvious significant difference in the trend or species composition of the pelagic fishery has occurred since the last annual report, although rigorous statistical methods have never been applied to the data. The 1988 mahimahi season produced record landings while billfish and wahoo landings declined from the previous year.

7.2 Fishing Effort

Annual effective fishing effort (trips) for the PMUS group and the PMUS species are plotted in Figures 4 and 5, respectively. No long-term trends are obvious, although no statistical methods have been applied to the data to test this statement.

7.3 Catch Rate

Annual, long-term monthly, and average monthly catch rates (Figures 6-10) show fluctuating annual catch rates, distinct seasonality, and higher catch rates for each species during its highest seasonal abundance. No long-term trends in catch rates are obvious, but no statistical analyses have been performed on the data.

8. Seasonal Patterns of Fishing

Except for the excellent mahimahi season, no noticeable differences occurred in the seasonal pattern of the pelagic fishery during 1988. Average monthly landings indicate that January-April is the best season for PMUS although there is an increase in October as well (Figure 13). The tuna fishery exhibits a seasonality with higher landings from April through the summer months and lower landings in the winter. The landings of the miscellaneous pelagics and all others categories show little evidence of any seasonality. Figure 14 indicates that the January-April PMUS season is due to the landings of mahimahi, while the fall season is due to the entry of wahoo into the fishery. Landings of billfish increase from June-September but are still small. Shark landings are too small to discern any seasonality. The long-term monthly landings of mahimahi, wahoo, and marlin show distinct seasonal patterns (Figures 15-17). Seasonality in landings may also be affected by the influence of seasonal weather patterns on the number of trips made by the relatively small boats that comprise the CNMI's fleet. This relationship requires further examination.

9. Size Composition

Size composition statistics were not available for 1988.

ENFORCEMENT ACTIVITIES, PLAN ADMINISTRATION, AND PROBLEMS

This section should be added by the NMFS Enforcement branch and the U.S. Coast Guard.

RESEARCH RESULTS

The DFW has implemented a new pelagic species sampling scheme to determine the biological characteristics of local fish populations. Data on species taken by trolling will be collected by DFW field trips at least three times per month, rather than once a month as done previously. Sampling periods will coincide with lunar phases (new, full, and quarter), and data will be collected on species, body size, sex, gonad state and weight, and area of capture. Gonadosomal indices will be calculated for each species. Data will be analyzed to determine life history characteristics of local species populations in waters off Saipan and Tinian.

PROBLEMS REQUIRING COUNCIL CONSIDERATION AND ACTION

The fishery seems stable, and DFW staff identified no problems requiring Council action.

ASSESSMENT OF MONITORING PROCESS

Existing computer programs for summarizing and analyzing available data are insufficient to properly monitor the resource and describe the fishery. Assistance is needed to develop these tools to be used by DFW biologists in preparation of subsequent annual reports.

RECOMMENDED ACTIONS

To date, only visual interpretations have been used on the data. More thorough and statistically valid analyses should be performed on the data to determine whether trends or problems actually exist in this fishery. The Team should identify specific questions about the fishery; form hypotheses to answer these questions; determine analytical methods to test these hypotheses; provide guidelines for interpreting the analyses; and determine what constitutes trends, changes, or problems in the fishery. The team should develop specific recommendations for format and content of the annual report modules. A special 2- to 5-day workshop should be held, possibly in concert with the Bottomfish Team and select members of the Council's Scientific and Statistical Committee, to resolve these problems for all Council management areas.

The creel survey data that DFW has been collecting since 1986 should be included in the description and analysis of the pelagic fishery. Computer programs are need to do this.

The commercial landings system should be improved on Saipan (coverage increased and/or verified) and expanded to Tinian and Rota. Enforcement of data submission and accuracy should be increased.

Length-frequency and biological sampling should be implemented to monitor the major pelagic species.

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1988. 1987 Western Pacific Regional Fishery Management Council annual report for the Fishery Management Plan for the Pelagic Fisheries of the Western Pacific Region. Western Pacific Regional Fishery Management Council, 1164 Bishop Street, Honolulu, HI 96813, var. pag.

APPENDIX A: TABLES

Table 1

Summary of the CNMI Commercial Pelagic Fishery, 1979-88

		1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Number of fishermen (boats) landing pelagics		36	21	24	29	92	97	75	96	60	77
Number of trips which landed pelagics		556	94	102	163	1408	1847	1446	1492	1079	1425
Number of fishermen (boats) landing over 5,000 pounds of pelagics in the year		4	1	1	3	14	13	9	13	8	13
Number of fishermen (boats) landing over 10,000 pounds of pelagics in the year		3	0	1	1	6	9	4	7	5	8
Percent of total pelagics landed, that were landed by fishermen with over 5,000 pounds for the year		89	40	90	85	79	79	63	75	64	82
Percent of total pelagics landed, that were landed by fishermen with over 10,000 pounds for the year		83	0	90	73	50	67	44	57	52	68
Total landings of Pelagic species (including Tunas)	Pounds	103030	15591	90097	104203	196788	272909	187378	245967	164055	267619
	Dollars	89158	19162	104558	112102	198710	264203	195372	267013	190150	327260

Table 2

CNMI ANNUAL COMMERCIAL LANDINGS OF PELAGIC SPECIES
DIVISION OF FISH AND WILDLIFE

EFFORT, SALES, AND REVENUE
BY YEAR AND SPECIES

YEAR	FISHING METHOD	SPECIES	NUMBER TRIPS	WEIGHT (LBS)	REVENUE ($)	PRICE ($/LB)
1979	UNSPECIFIED	PMUS TOTAL	155	16363	16170	0.99
		MAHIMAHI	104	11603	10562	0.91
		WAHOO	49	3788	4477	1.18
		BILLFISH TOTAL	6	972	1131	1.16
		MARLIN-UNSPECIFIED	6	972	1131	1.16
		TUNAS TOTAL	454	86078	72306	0.84
		PMUS & TUNAS	552	102441	88476	0.86
		PELAGICS-MISC. TOTAL	13	589	682	1.16
		RAINBOW RUNNER	4	318	379	1.19
		MISC. TROLL FISH	9	271	303	1.12
		ALL PELAGICS	556	103030	89158	0.87
1980	UNSPECIFIED	PMUS TOTAL	12	4186	6184	1.48
		MAHIMAHI	7	2150	3225	1.50
		WAHOO	11	1879	2802	1.49
		BILLFISH TOTAL	1	157	157	1.00
		MARLIN-UNSPECIFIED	1	157	157	1.00
		TUNAS TOTAL	90	10595	11751	1.11
		PMUS & TUNAS	94	14781	17935	1.21
		PELAGICS-MISC. TOTAL	8	810	1227	1.51
		RAINBOW RUNNER	5	140	222	1.59
		MISC. TROLL FISH	7	670	1005	1.50
		ALL PELAGICS	94	15591	19162	1.23
1981	UNSPECIFIED	PMUS TOTAL	29	15866	19725	1.24
		MAHIMAHI	27	7008	8198	1.17
		WAHOO	13	6763	9163	1.35
		BILLFISH TOTAL	5	2015	2244	1.11
		MARLIN-UNSPECIFIED	5	2015	2244	1.11
		SHARKS	2	80	120	1.50
		TUNAS TOTAL	88	66832	73607	1.10
		PMUS & TUNAS	102	82698	93332	1.13
		PELAGICS-MISC. TOTAL	11	7400	11226	1.52
		RAINBOW RUNNER	4	511	876	1.72
		MISC. TROLL FISH	10	6889	10350	1.50
		ALL PELAGICS	102	90098	104558	1.16

Table 2 (Cont.)

YEAR	FISHING METHOD	SPECIES	NUMBER TRIPS	WEIGHT (LBS)	REVENUE ($)	PRICE ($/LB)
1982	UNSPECIFIED	PMUS TOTAL	30	18632	21571	1.16
		MAHIMAHI	17	12468	14791	1.19
		WAHOO	22	6124	6719	1.10
		BILLFISH TOTAL	1	10	31	3.08
		MARLIN-UNSPECIFIED	1	10	31	3.08
		SHARKS	1	30	30	1.00
		TUNAS TOTAL	157	80185	83643	1.04
		PMUS & TUNAS	160	98817	105214	1.06
		PELAGICS-MISC. TOTAL	14	3357	4860	1.45
		RAINBOW RUNNER	9	3137	4615	1.47
		MISC. TROLL FISH	7	220	245	1.11
		ALL PELAGICS	163	102174	110074	1.08
1983	UNSPECIFIED	PMUS TOTAL	324	21236	23248	1.09
		MAHIMAHI	204	11151	11316	1.01
		WAHOO	131	7008	8461	1.21
		BILLFISH TOTAL	24	3077	3471	1.13
		SAILFISH	1	47	71	1.50
		MARLIN-UNSPECIFIED	23	3030	3400	1.12
		TUNAS TOTAL	1207	165600	164763	0.99
		PMUS & TUNAS	1340	186836	188011	1.01
		PELAGICS-MISC. TOTAL	94	9953	10699	1.07
		RAINBOW RUNNER	23	818	994	1.21
		MISC. TROLL FISH	72	9135	9705	1.06
		ALL PELAGICS	1408	196789	198710	1.01
1984	UNSPECIFIED	PMUS TOTAL	296	18596	21635	1.16
		MAHIMAHI	128	6091	6026	0.99
		WAHOO	178	11270	14215	1.26
		BILLFISH TOTAL	12	1235	1394	1.13
		MARLIN-UNSPECIFIED	12	1235	1394	1.13
		TUNAS TOTAL	1688	250966	238129	0.95
		PMUS & TUNAS	1826	269562	259764	0.96
		PELAGICS-MISC. TOTAL	38	3347	4439	1.33
		RAINBOW RUNNER	14	527	615	1.17
		MISC. TROLL FISH	24	2820	3824	1.36
		ALL PELAGICS	1847	272909	264203	0.97

Table 2 (Cont.)

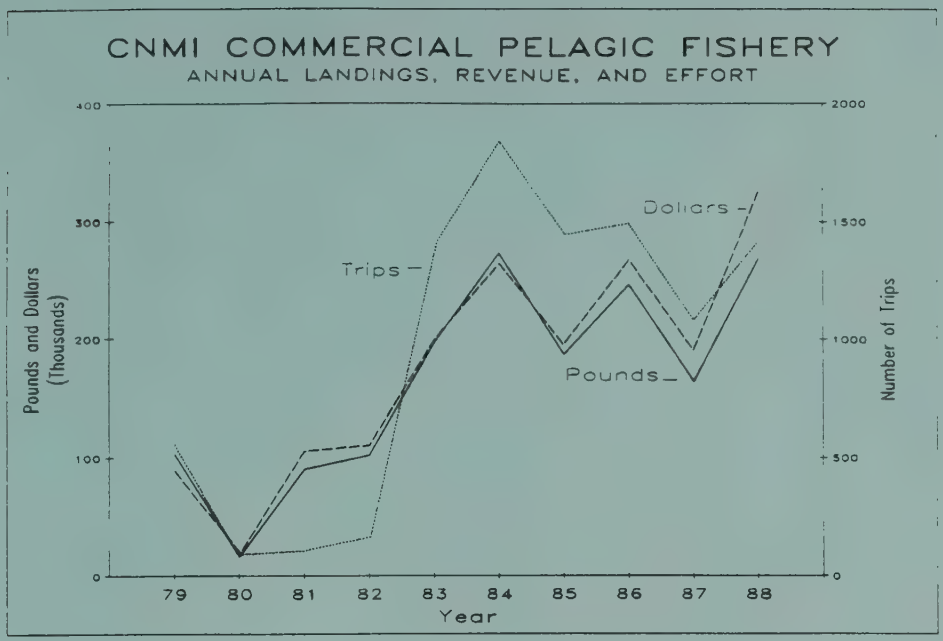
YEAR	FISHING METHOD	SPECIES	NUMBER TRIPS	WEIGHT (LBS)	REVENUE ($)	PRICE ($/LB)
1985	UNSPECIFIED	PMUS TOTAL	374	26515	30306	1.14
		MAHIMAHI	194	10364	10726	1.03
		WAHOO	196	14601	17713	1.21
		BILLFISH TOTAL	7	1550	1867	1.20
		SAILFISH	1	62	55	0.90
		MARLIN-UNSPECIFIED	6	1488	1812	1.22
		TUNAS TOTAL	1226	154473	158027	1.02
		PMUS & TUNAS	1421	180988	188333	1.04
		PELAGICS-MISC. TOTAL	52	6390	7038	1.10
		RAINBOW RUNNER	15	516	555	1.08
		MISC. TROLL FISH	40	5874	6483	1.10
		ALL PELAGICS	1446	187378	195371	1.04
1986	UNSPECIFIED	PMUS TOTAL	249	23701	28392	1.20
		MAHIMAHI	155	14237	16633	1.17
		WAHOO	108	7250	9421	1.30
		BILLFISH TOTAL	19	2214	2338	1.06
		SAILFISH	2	91	114	1.25
		MARLIN-UNSPECIFIED	18	2123	2224	1.05
		TUNAS TOTAL	1346	220123	235985	1.07
		PMUS & TUNAS	1477	243824	264377	1.08
		PELAGICS-MISC. TOTAL	39	2144	2636	1.23
		RAINBOW RUNNER	22	655	842	1.29
		MISC. TROLL FISH	18	1489	1794	1.20
		ALL PELAGICS	1492	245968	267013	1.09
1987	UNSPECIFIED	PMUS TOTAL	233	20360	25876	1.27
		MAHIMAHI	120	7602	9956	1.31
		WAHOO	112	10723	13582	1.27
		BILLFISH TOTAL	15	2035	2338	1.15
		SAILFISH	1	67	107	1.60
		MARLIN-UNSPECIFIED	14	1968	2231	1.13
		TUNAS TOTAL	930	142673	163092	1.14
		PMUS & TUNAS	1073	163033	188968	1.16
		PELAGICS-MISC. TOTAL	14	1022	1183	1.16
		RAINBOW RUNNER	9	526	684	1.30
		MISC. TROLL FISH	5	496	499	1.01
		ALL PELAGICS	1079	164055	190151	1.16

Table 2 (Cont.)

YEAR	FISHING METHOD	SPECIES	NUMBER TRIPS	WEIGHT (LBS)	REVENUE ($)	PRICE ($/LB)
1988	UNSPECIFIED	PMUS TOTAL	349	35044	47761	1.36
		MAHIMAHI	260	24639	34069	1.38
		WAHOO	103	9358	12466	1.33
		BILLFISH TOTAL	8	1047	1226	1.17
		MARLIN-UNSPECIFIED	8	1047	1226	1.17
		TUNAS TOTAL	1219	228822	274867	1.20
		PMUS & TUNAS	1414	263866	322628	1.22
		PELAGICS-MISC. TOTAL	34	3753	4632	1.23
		RAINBOW RUNNER	31	3483	4358	1.25
		MISC. TROLL FISH	5	270	274	1.02
		ALL PELAGICS	1425	267619	327260	1.22

APPENDIX B: FIGURES

Figure 1



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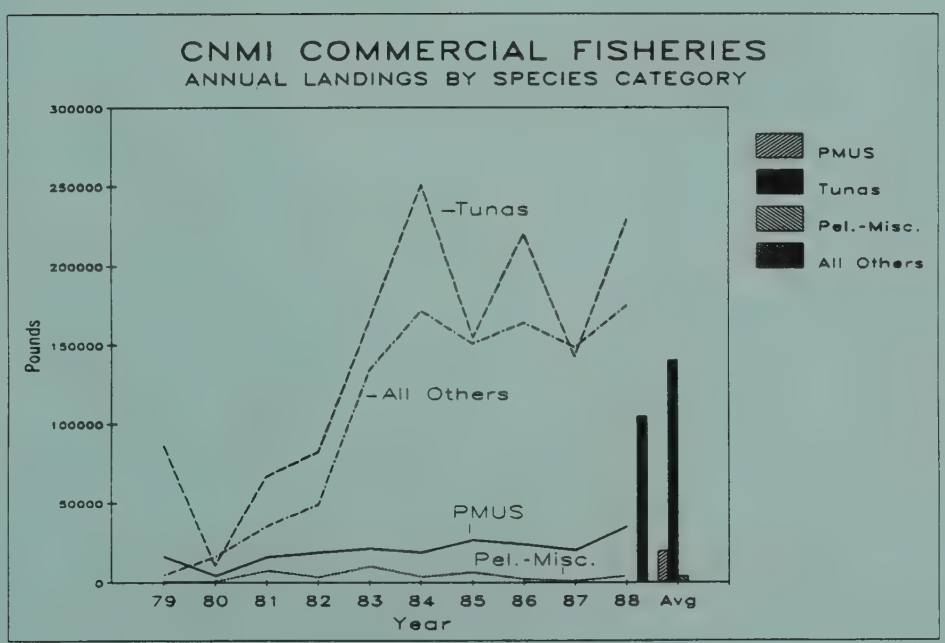

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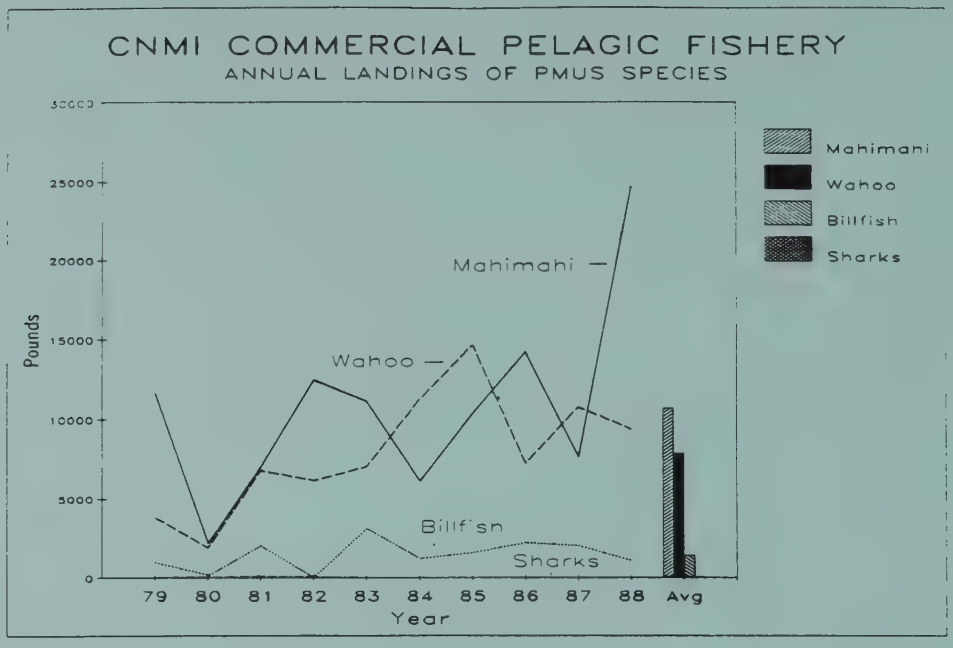

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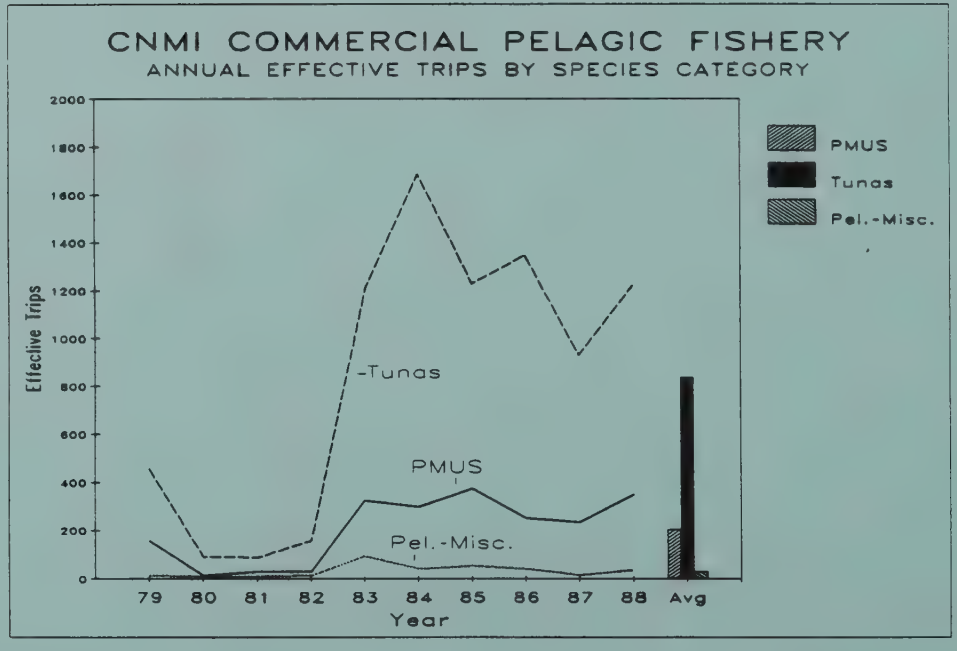

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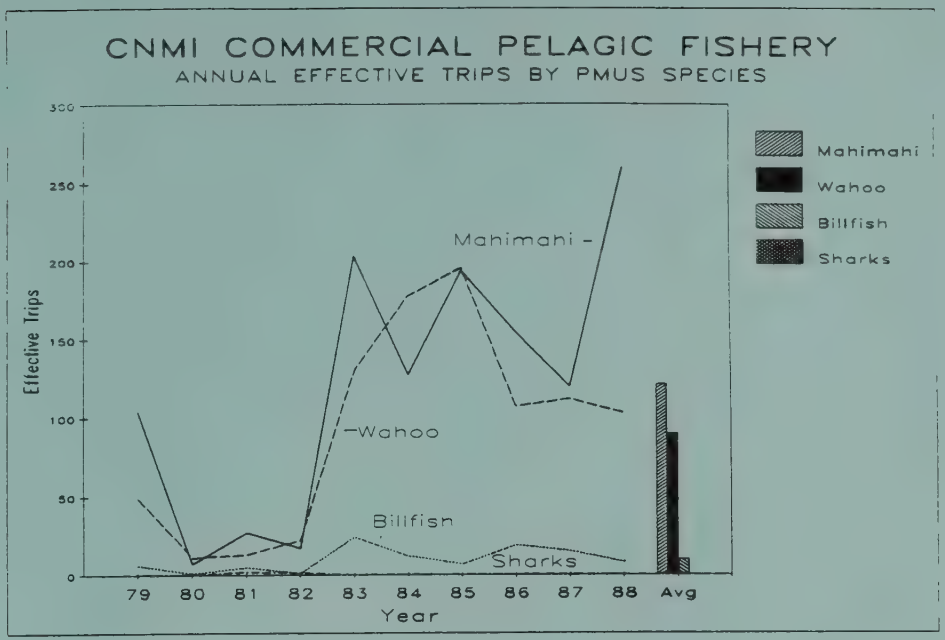

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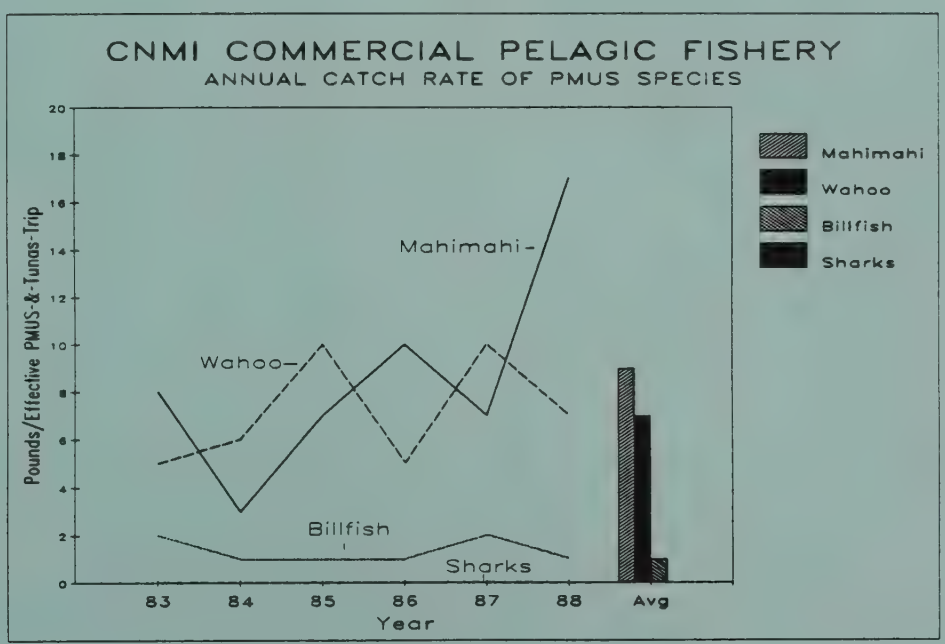

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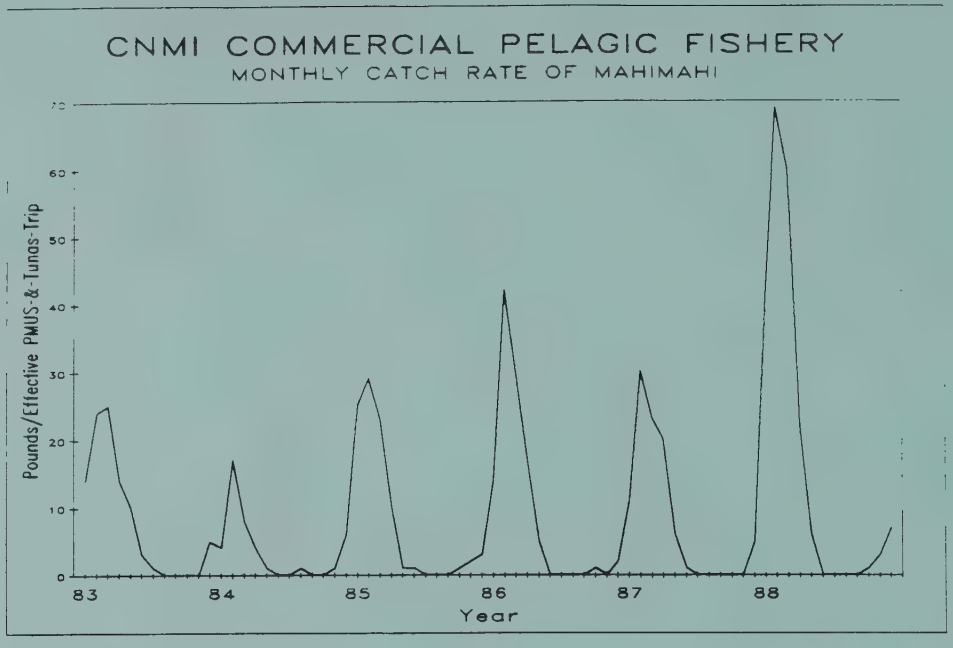

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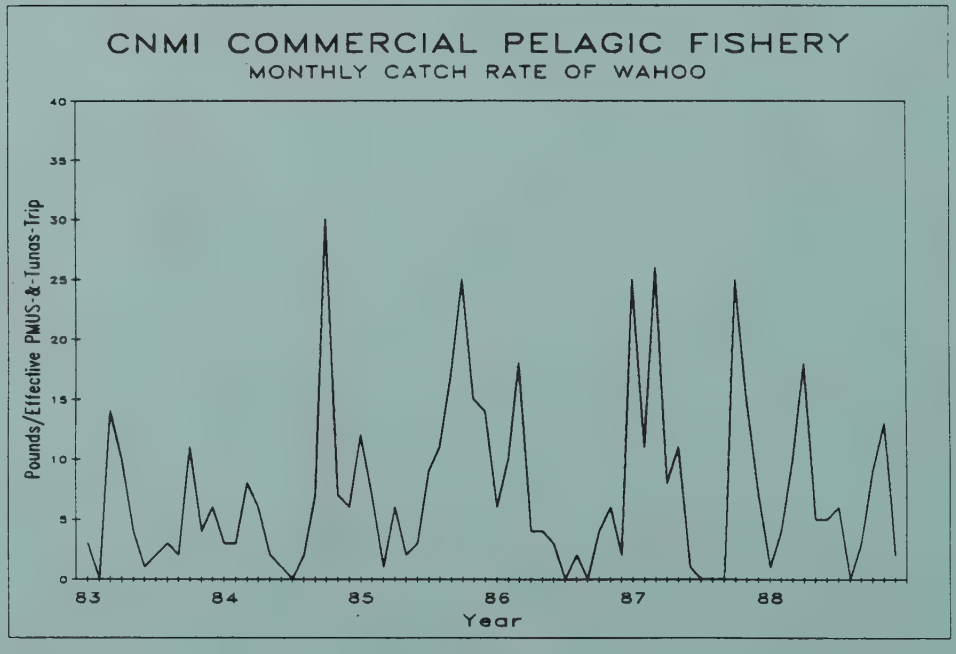

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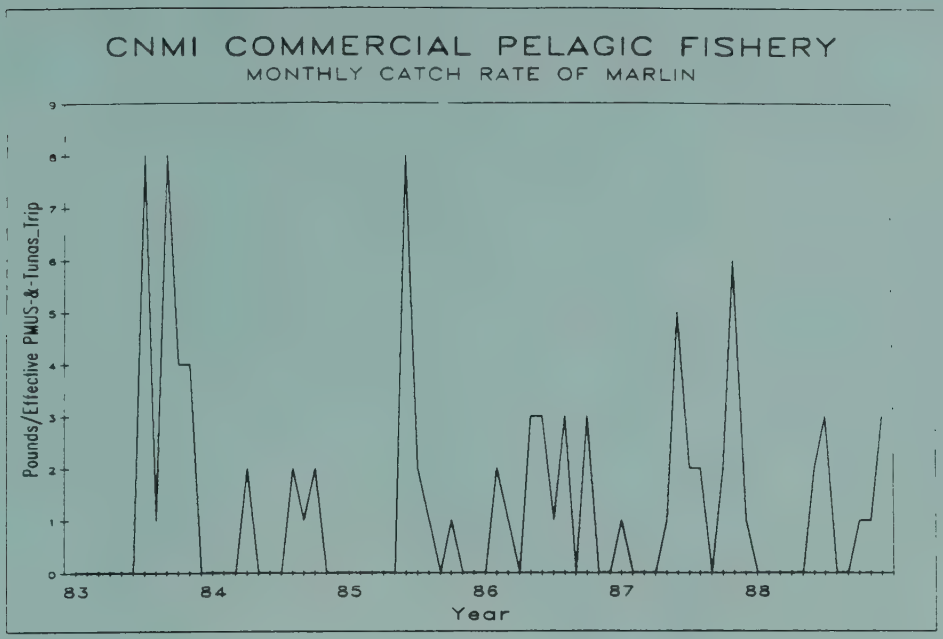

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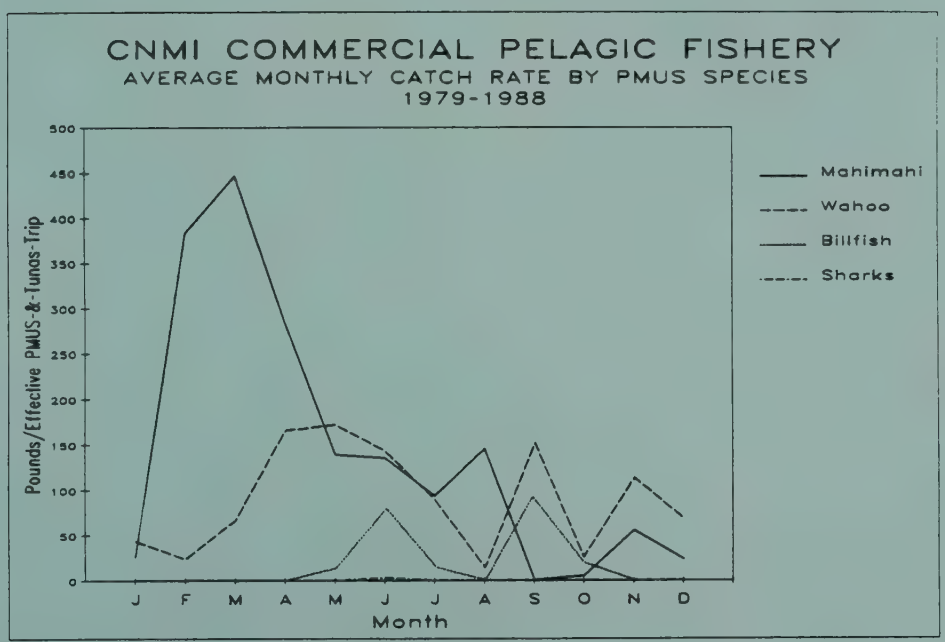

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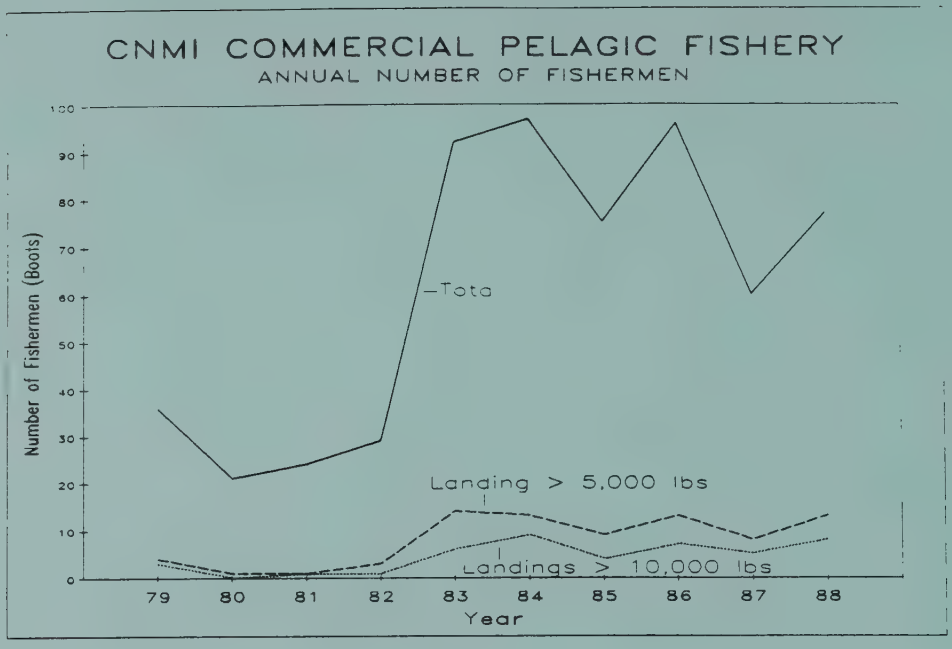

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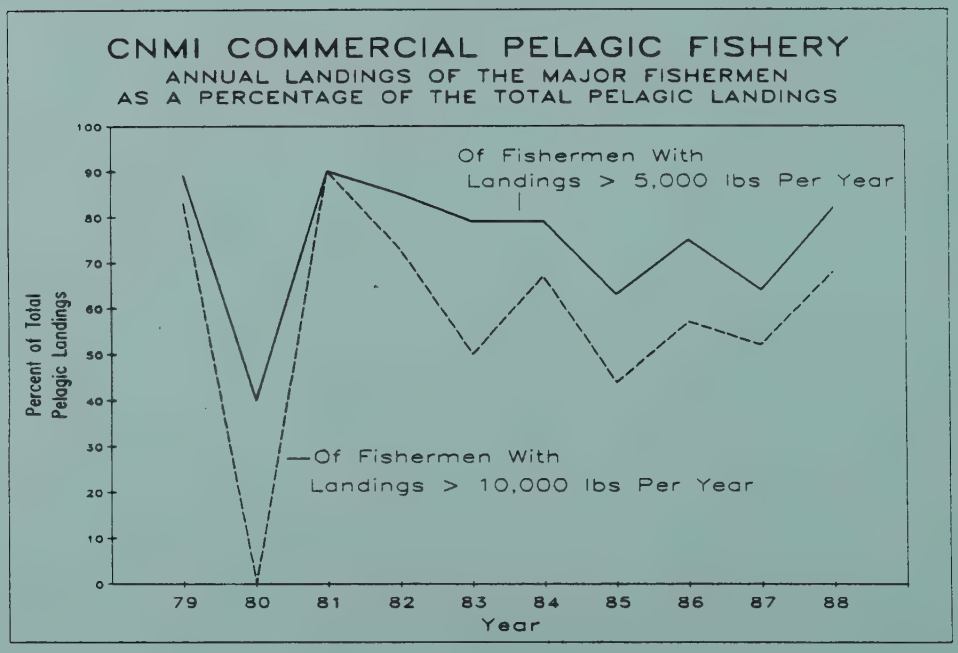

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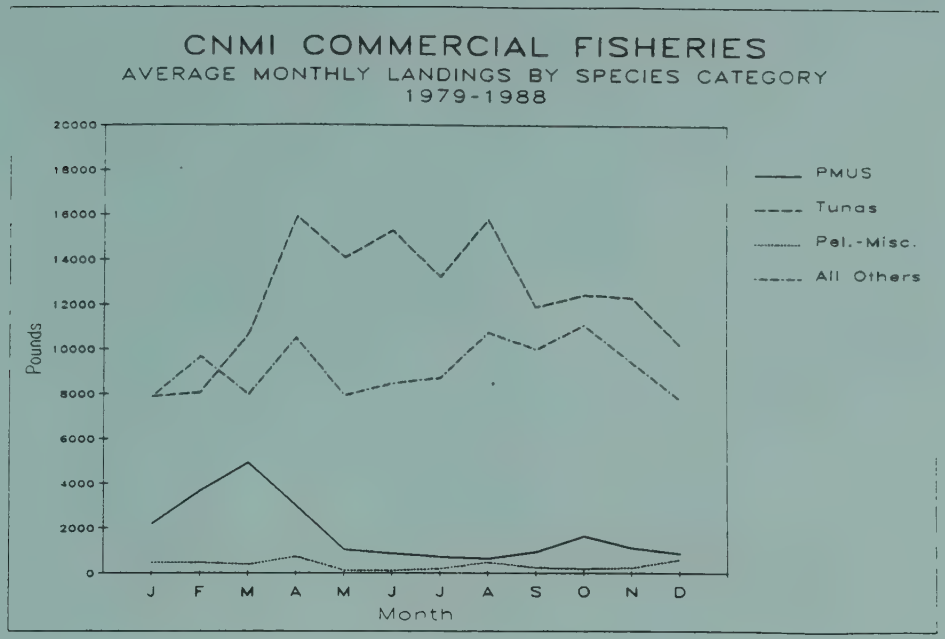
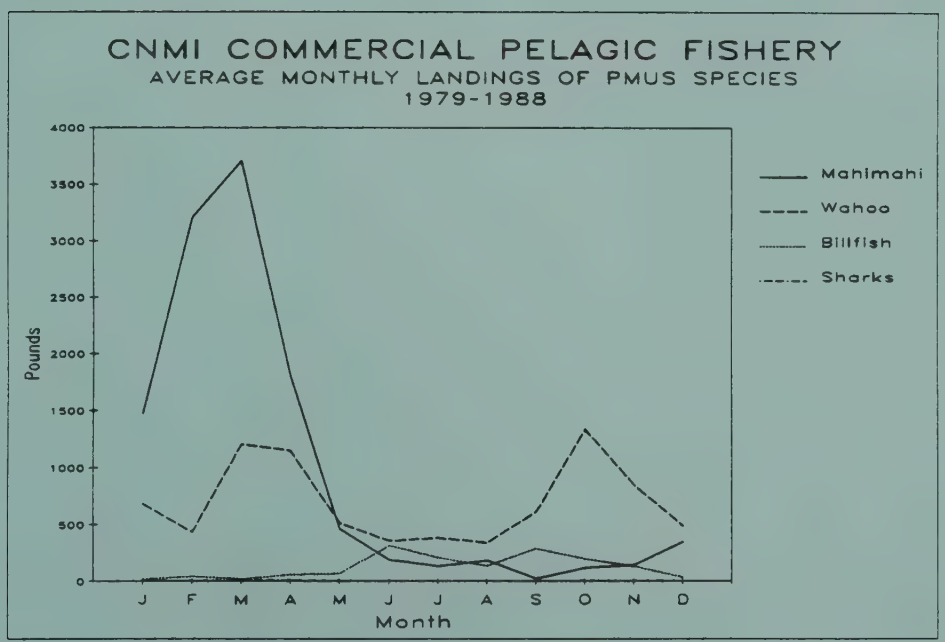


Figure 14



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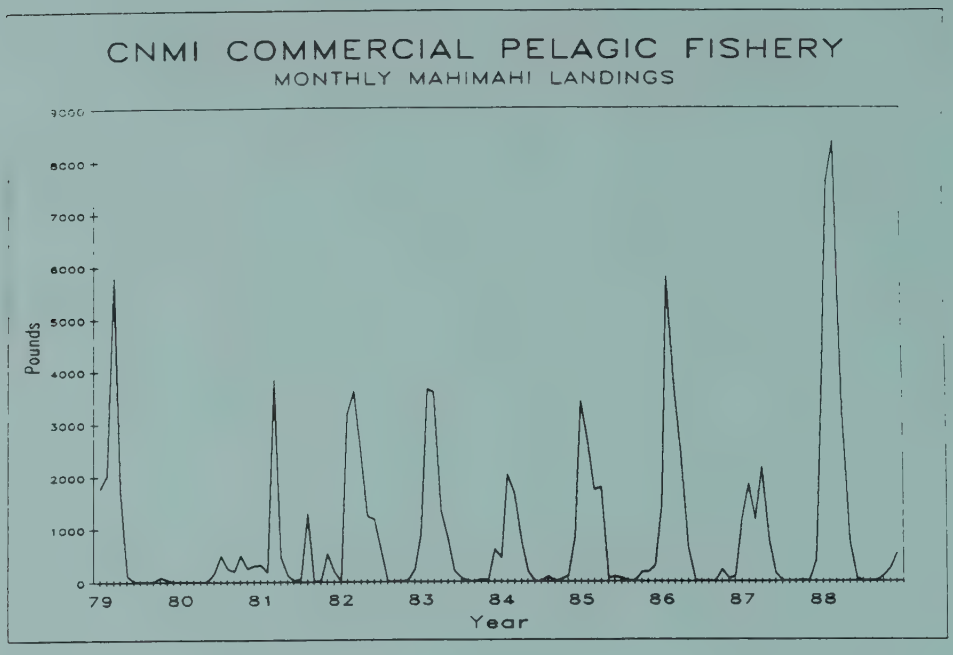


Figure 16

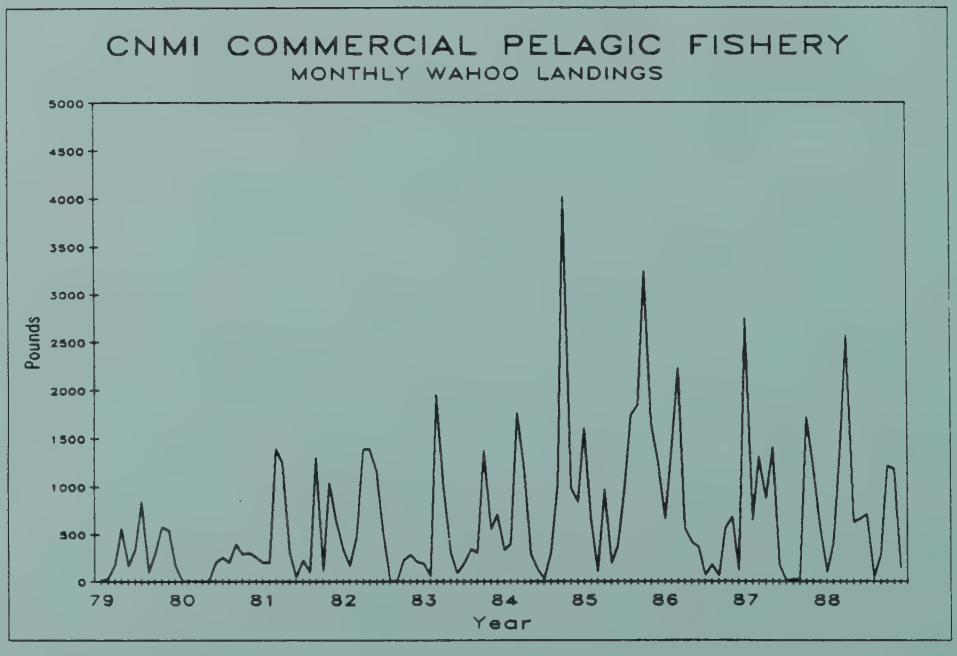
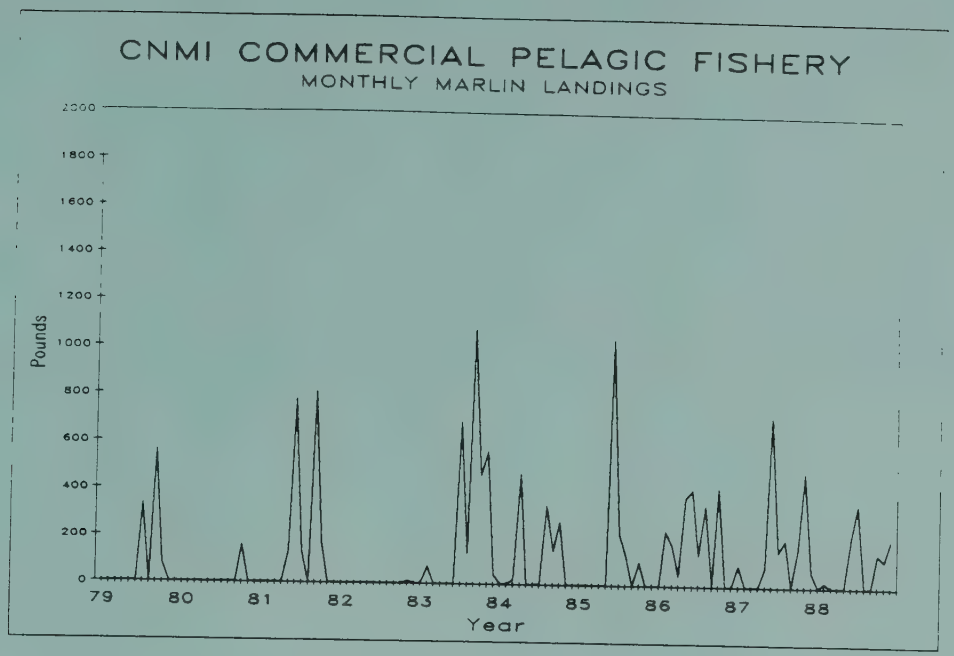


Figure 17


CNMI COMMERCIAL PELAGIC FISHERY
MONTHLY MARLIN LANDINGS
2000
1800
1600
1400
1200
1000
800
600
400
200
0
Pounds
79
80
81
82
83
84
85
86
87
88
Year

HONOLULU LABORATORY PELAGIC FISHERY REPORT MODULE

Southwest Fisheries Center Administrative Report H-89-11

WESTERN PACIFIC PELAGIC FISHERIES IN 1988

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NOT FOR PUBLICATION

INTRODUCTION

This report presents summary information on the current status of pelagic fisheries in American Samoa, Guam, Hawaii, and the Commonwealth of the Northern Mariana Islands (CNMI). The pelagic management unit species (PMUS) comprise various marlins and other billfish, mahimahi, ono (wahoo), and sharks, which are managed by a fishery management plan (FMP) prepared by the Western Pacific Regional Fishery Management Council (Council). Also included in this report is information on the major tuna species in the region. Information is presented on 1) the small-scale fisheries in American Samoa, Guam, and the CNMI for PMUS and tunas; 2) the by-catch of the foreign longline fisheries supporting tuna canneries in American Samoa; and 3) Hawaii's larger commercial fisheries for PMUS and tunas. All information is based on commercial landings. Although recreational and subsistence fisheries are important in the western Pacific and may comprise a larger percentage of the actual total landings of some pelagic species than the commercial catch, availability of these data is either limited (Guam) or nonexistent (American Samoa, Hawaii, and the CNMI).

This report serves as a "module" to an annual report on these fisheries that is prepared by the Council's PMUS Plan Monitoring Team. Information on the biological status of PMUS will be included in a separate module, which contains the scientific names of relevant species. This report provides only the common names for fishes. Most of the information for American Samoa, Guam, and the CNMI comes from the Western Pacific Fishery Information Network (WPACFIN) (Hamm and Quach 1989). Each of these areas has a separate module in the PMUS annual report, which discusses the fisheries much more fully. Data are presented in pounds throughout this report, which is the industry and local government standard in the western Pacific (1 pound is 0.45 kilogram; 1 kilogram is 2.2 pounds).

DOMESTIC PELAGIC FISHERIES OF AMERICAN SAMOA, GUAM, AND THE CNMI

The pelagic fisheries of American Samoa, Guam, and the CNMI continue to show substantial annual variability. Commercial landings are subject to a number of factors; central among these factors are the biological and environmental conditions, the development of domestic and export markets for locally caught fish, and alternative employment opportunities for fishermen. Guam has shown the most sustained increase in PMUS landings, whereas American Samoa and the CNMI have shown little growth in PMUS landings since 1982. Tuna landings from the latter two areas have grown since 1982, but Guam's landings have not. Data from WPACFIN reports for 1982-87 are summarized in Tables 1-3. Interpretation of trends (Fig. 1) should be made cautiously, according to the provisos raised in the original WPACFIN reference reports. Average prices for PMUS are relatively low in all three areas, except for Guam, where mahimahi, ono, and yellowfin tuna have become significant export species (Table 4).

FISHERIES SUPPORTING CANNERIES IN AMERICAN SAMOA

American Samoa has two canneries, which receive fish from three major sources: U.S. tuna purse seiners fishing for skipjack tuna (with a substantial by-catch of yellowfin tuna), U.S. albacore trollers fishing seasonally in the South Pacific, and foreign tuna longliners concentrating on albacore. Information on the PMUS by-catch of the foreign longline fishery is provided by the National Marine Fisheries Service (NMFS), which has a sampling program in American Samoa (Ito and Yamasaki 1988). The data are compiled by date of capture from voluntary logbooks carried by the foreign longline fishery. Date of capture rather than the date of landing is used to avoid disclosing confidential cannery information. Data are only available through 1987 because of the length of longline trips and data processing requirements.

In 1987, the foreign longline fleet based in American Samoa consisted of 128 vessels (326 trips). Most of the vessels were of Taiwanese and South Korean nationality with one vessel from Tonga. Twenty-five longliners (51 trips) also off-loaded a small proportion of their by-catch sashimi to the canneries. Most of the catch of the sashimi vessels was transshipped from American Samoa and sold as fresh-frozen fish.

Foreign longline landings increased from 29,300 metric tons (t) in 1986 to 37,800 t in 1987. Albacore comprised 72.4% of the catch in 1987, followed by yellowfin tuna (11.9%) and bigeye tuna (5.2%) (Table 5). Miscellaneous species represented 10.6% of the catch--PMUS comprised 6.7% of total catch (Fig. 2). Blue marlin was the largest individual component of the by-catch equaling 5.0% of the total catch. Other PMUS were negligible. A substantial domestic industry has developed in American Samoa; various PMUS and other species landed by the foreign longliners but not destined for the canneries are filleted and exported to Hawaii and the U.S. mainland.

Tuna are transshipped through Guam and Tinian in the CNMI by U.S. and foreign purse seine vessels and by foreign longline tuna vessels, but up-to-date data are not available on these operations. At various times, problems have arisen from the domestic sales of the PMUS by-catch from these vessels, but the extent of these sales is not known.

HAWAII'S PELAGIC FISHERIES

The recent, dramatic changes in Hawaii's pelagic fisheries continued in 1988 with the explosion of interest in tuna longlining. The number of tuna longliners operating in Hawaii rose from 37 in 1985 to 50 in 1988, with more arriving throughout the first half of 1989 (the figure stood at 65 at the end of the first quarter). Most of these vessels are targeting bigeye tuna with an eye toward the Japanese export market, but some vessels are targeting PMUS, e.g., swordfish. Coincident with the expansion of the domestic longline fleet, local wholesale fish distributors have begun experimenting with the transshipment and sale of fresh fish, which are caught by foreign longline fishing vessels operating in the waters around

Hawaii. Together these two developments have raised the public's awareness of Hawaii's pelagic fisheries, with substantial concern on the part of local recreational and sportfishers, and small-scale commercial fishers.

Data Sources and Problems

Our estimates of Hawaii's pelagic landings are derived from the NMFS shoreside monitoring program, which samples fish sold in Hawaii's fresh fish markets. From this monitoring program, it is possible to estimate commercial landings of many pelagic species--especially landings by the major commercial fleets--independently of the State of Hawaii's commercial landings reporting system. However, the monitoring program covers only a portion of the entire market (with most information derived from Oahu and the Big Island) and consists of a nonrandom sample, not a census, of these markets. The sample data are "scaled" to market-wide quantities through raising factors, which range from 1.1 to 2.0. These factors were applied consistently to the 2 years (1987 and 1988) for which we have complete pelagic data. Even though the market structure has been changing in this period, we do not have a recent statistical base on which to verify our raising factors. Therefore, these estimates must be considered provisional and used with care.

Data from the Hawaii Division of Aquatic Resources (HDAR) for commercial fish landings were unavailable for 1988 at the time of this report's preparation. There is considerable concern that the HDAR data severely undercount Hawaii's landings, as can be seen by comparing HDAR records of total longline landings of PMUS for 1987 (350,000 pounds) with our estimate (3.3 million pounds) or the HDAR figure for bigeye tuna (204,400 pounds) with our estimate (1.9 million pounds). In neither case is there any question of our raising factors being excessive.

Estimates

Our estimate of Hawaii's pelagic landings in 1988 is outlined in Table 6. We estimate that PMUS landings reached 3.8 million pounds in 1988, valued at $5.8 million (Fig. 3). This represents a 15% increase in landings (by weight) but, because of lower prices and a change in species composition (Table 7), only a 2% increase in value. (Apparently 1988 was a poor year for mahimahi landings in Hawaii.) Tuna landings increased 31% to 12 million pounds valued at $23.2 million (up 32% in value); excluding skipjack tuna, landings increased 39% or 7.7 million pounds. Bigeye tuna, the focus of the longline tuna fleet expansion, increased in landings by 60%.

In terms of fleet activity, longline fishing grew substantially in 1988, with longline landings (including tunas) up 73% from our 1987 estimate (Table 8). We estimate that longline trips increased from 435 in 1987 to 627 in 1988. Landings from the trolling and handline fisheries for tunas were static (Fig. 4), falling 4% in 1988. The decline in these fisheries was due to a decline in mahimahi landings (Fig. 5). The majority

of the PMUS were landed by vessels using longline and trolling gear (Fig. 6A), whereas the majority of the tunas were landed by longline and other types of gear (Fig. 6B). Landings by other types of gear include those from distant-water trollers, the aku (skipjack tuna) boat fleet, and the various fleets in the Northwestern Hawaiian Islands (primarily bottom fish and lobster). Gear shares for individual PMUS species and tunas are shown in Figures 6C and 6D, respectively.

Trolling gear caught the vast majority of the blue marlin and mahimahi, whereas longline gear caught most of the striped marlin in 1988. Similar differences existed for yellowfin and bigeye tunas. Species composition of catches by trolling and handline gear is estimated using State of Hawaii gear shares for 1987, because the NMFS sampling program does not provide a good basis for distinguishing between these two gear types. Vessels using longline gear caught mostly tunas (bigeye, yellowfin, and albacore) while handliners concentrated on yellowfin tuna (Fig. 7). Trollers landed a wide variety of species, with yellowfin tuna and blue marlin being the largest components.

Prices for pelagic species in 1988 were not much different from those in 1987 (Fig. 8). In general, the trolling and handline prices were better for the PMUS group, while longline landings claimed the higher prices for tunas (Table 9).

HAWAII'S IMPORTS

The NMFS Southwest Region Market News Service provides annual summaries of Hawaii's imports of fishery products. The data are compiled from the inspection program of the U.S. Food and Drug Administration. These data provide a more complete species breakdown of fishery data than do the data from U.S. Customs, but they are incomplete because not all lots are sampled or are available for tabulation. These data do not include imported seafood products that are shipped to Hawaii from other U.S. Customs districts, such as Los Angeles. Some imports may be transshipped from Hawaii to other U.S. locations.

Imports of PMUS to Hawaii were slightly higher in 1988 (3.15 million pounds, independent of product form) than in 1987, but less than in 1985 and 1986 (Fig. 9). Most of these imports were frozen mahimahi fillets; however, in 1988, over 500,000 pounds of ono (wahoo) in the round were imported to Hawaii in 1988 (Table 10).

The NMFS Market News does not provide prices for imported seafood. However, if the NMFS wholesale seafood market monitoring program's average price for imported pelagic species (in the round) is applied, then the 1988 imports of round-weight PMUS would be worth approximately $1.5 million and tuna imports would be $2.7 million. The value of filleted and other product forms is not known.

RESEARCH

Two studies were reported on the fishing operations, markets, and economics of pelagic species in 1989. One is a study of the operations and economics of small boat fishing in American Samoa, Guam, and the CNMI. The study is based on a cooperative survey facilitated by the Council and conducted by agencies in each region. The data have been compiled into a preliminary report (Kasaoka 1989), and will be analyzed later this year. The second study (Kawamoto et al. 1989) conducted by NMFS Honolulu Laboratory researchers, is on the operations of Hawaii's longline fishing fleet in 1987-88. It outlines the history of the longline fishery, describes the types of gear used historically and recently, and provides data on fleet activity and landings obtained from the NMFS shoreside monitoring program.

Two planned studies concerning pelagic fisheries did not get off the ground in 1988. First, a survey of Hawaii's wholesale and retail seafood market channels was expected to be conducted this year through the NMFS Honolulu Laboratory. However, because of delays in contractual and survey approvals, the project has been postponed until 1990. Results from this survey should reveal how Hawaii's seafood market has changed over the past 10 years. Second, the Council and the HDAR, with the assistance of NMFS, have been working on the design for a survey of small boat fisheries in Hawaii to provide better estimates of part-time commercial, recreational, and subsistence catches. The HDAR has funds from NMFS to field this survey for 1 year, which is expected to begin early in 1990. Results from this survey should provide a better idea of the relative importance of the commercial data used in existing status reports or pelagic species.

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Table 1.--Pelagic species commercial landings in American Samoa, 1982-87 (from WPACFIN data (Hamm and Quach 1989)).

Common name	Pounds landed							Revenue (US$) 1987	
	5-year average 1982-86	1982	1983	1984	1985	1986	1987	Total	Price/ pound
Pelagic management unit species (PMUS)									
Swordfish	33	0	0	0	163	0	0		NA
Blue marlin	2,807	315	1,083	5,675	2,790	4,171	233	186	0.80
Sailfish	808	127	74	989	2,744	107	1,153	1,153	1.00
Marlin	0		0	0	0	0	0		NA
Marlins	3,648	442	1,157	6,664	5,697	4,278	1,386	1,339	0.97
Sharks	565	45	293	723	1,026	738	0	0	NA
Rainbow runner	746	24	655	2,305	558	190	19	15	0.79
Wahoo	1,410	113	632	1,637	2,357	2,311	1,419	1,988	1.40
Mahimahi	4,355	745	1,442	1,807	7,394	10,388	2,445	3,023	1.24
Total PMUS	10,724	1,369	4,179	13,136	17,032	17,905	5,269	6,365	1.21
Tunas									
Skipjack tuna	68,040	15,005	54,841	114,926	35,236	120,194	104,974	74,325	0.71
Dogtooth tuna	1,393	170	917	2,627	974	2,278	1,340	1,337	1.00
Yellowfin tuna	33,698	6,933	18,956	58,609	35,707	48,283	30,522	39,207	1.28
Bigeye tuna	706	0	0	0	3,528	0	0	0	NA
Kawakawa	480	109	368	769	1,125	29	127	127	1.00
Albacore	14,031		10,904	20,390	24,831	0	0	0	NA
Tuna (other)	4	18	0	0	0	0	0	0	NA
Total tuna	115,545	22,235	85,986	197,321	101,401	170,784	136,963	114,996	0.84

Table 2.--Pelagic species landings in Guam, 1982-87 (from Hamm and Quach 1989).

Common name	Pounds landed							Revenue (US$) 1987	
	5-year average 1982-86	1982	1983	1984	1985	1986	1987	Total	Price/ pound
Pelagic management unit species (PMUS)									
Swordfish	0	0	0	0	0	0	0	0	NA
Blue marlin	0	0	0	0	0	0	0	0	NA
Sailfish	397	244	0	426	354	959	1,247	1,221	0.98
Marlin	20,541	13,634	654	29,905	20,581	37,930	34,779	29,612	0.85
Marlins	20,937	13,878	654	30,331	20,935	38,889	36,026	30,833	0.86
Sharks	528	1,130	257	521	237	493	862	431	0.50
Rainbow runner	549	398	68	584	816	878	510	771	1.51
Wahoo	32,617	14,479	3,585	40,969	65,040	39,012	45,548	79,285	1.74
Mahimahi	35,409	34,118	13,518	20,336	45,828	63,244	46,886	74,610	1.59
Total PMUS	90,040	164,003	18,082	92,741	132,856	142,516	29,832	185,930	1.43
Tunas									
Skipjack tuna	28,247	30,384	2,658	57,328	26,724	24,143	17,137	17,085	1.00
Dogtooth tuna	3,452	2,354	165	3,438	5,980	5,322	2,521	3,321	1.32
Yellowfin tuna	28,732	30,722	1,328	39,441	44,395	27,775	40,466	69,028	1.71
Bigeye tuna	0	0	0	0	0	0	0	0	NA
Kawakawa	1	0	0	0	5	0	0	0	NA
Albacore	0	0	0	0	0	0	0	0	NA
Tuna (other)	91	387	30	40	0	0	0	0	NA
Total tuna	60,524	63,847	4,181	100,247	77,104	57,240	60,124	89,434	1.49

Table 3.--Pelagic species landings in the Commonwealth of the Northern Mariana Islands, 1982-87 (from Hamm and Quach 1989).

Common name	Pounds landed							Revenue (US$) 1987	
	5-year average 1982-86	1982	1983	1984	1985	1986	1987	Total	Price/ pound
Pelagic management unit species (PMUS)									
Swordfish	0	0	0	0	0	0	0	0	NA
Blue marlin	0	0	0	0	0	0	0	0	NA
Sailfish	50	0	47		61	91	67	107	1.60
Marlin	1,577	10	3,029	1,235	1,488	2,123	1,968	2,230	1.13
Marlins	1,617	10	3,076	1,235	1,549	2,214	2,035	2,337	1.15
Sharks	30	30							NA
Rainbow runner	1,130	3,136	818	527	516	654	526	683	1.30
Wahoo	9,250	6,123	7,008	11,269	14,600	7,250	10,722	13,581	1.27
Mahimahi	10,861	12,468	11,150	6,090	10,363	14,236	7,601	9,955	1.31
Total PMUS	22,864	21,767	22,052	19,121	27,028	24,354	20,884	26,556	1.27
Tunas									
Skipjack tuna	158,004	65,220	146,729	232,674	141,909	203,489	129,203	145,197	1.12
Dogtooth tuna	3,253	6,104	1,846	2,627	2,590	3,099	5,106	6,457	1.26
Yellowfin tuna	12,930	8,456	17,024	15,664	9,972	13,533	8,362	11,436	1.37
Bigeye	0	0	0	0	0	0	0	0	NA
Kawakawa	0	0	0	0	0	0	0	0	NA
Albacore	0	0	0	0	0	0	0	0	NA
Tuna (other)	81	405	0	0	0	0	0	0	NA
Total tuna	174,268	80,185	165,599	250,965	154,471	220,121	142,671	163,090	1.14

Table 4.--Pelagic species prices in American Samoa, Guam, and the Commonwealth of the Northern Mariana Islands (CNMI), 1987 (from Hamm and Quach 1989).

Common name	Price (US$) per pound		
	American Samoa	Guam	CNMI
Marlins	0.97	0.86	1.15
Mahimahi	1.24	1.59	1.31
Ono (wahoo)	1.40	1.74	1.27
Total PMUS	1.21	1.43	1.27
Skipjack tuna	0.71	1.00	1.12
Yellowfin tuna	1.28	1.71	1.37
Total tunas	0.84	1.49	1.14

Table 5.--American Samoa foreign longline fleet species composition, 1982-87. Data are from the NMFS monitoring program in American Samoa, based on date of capture.

Common name	Percent of total						
	5-year average 1982-86	1982	1983	1984	1985	1986	1987
Albacore	70.42	70.4	66.8	61.7	71.6	81.6	72.4
Yellowfin tuna	15.74	12.7	18.1	21.7	14.7	11.5	11.9
Bigeye tuna	8.84	9.6	10.9	10.8	7.9	5	5.2
Billfish	2.84	4.7	2.8	2.7	4	0	6.7
Other	2.16	2.7	1.5	3	1.7	1.9	3.8
Total	100.00	100.1	100.1	99.9	99.9	100.00	100.0

Table 6.--Hawaii's pelagic species market, 1987-88. Data are estimates from NMFS shoreside monitoring. Imports do not include transshipments from U.S. mainland.

Source	Landings (1,000's pounds)		Market revenue (US$1,000's)	
	1987	1988	1987	1988
Pelagic management unit species (PMUS)				
Hawaii landings	3,330	3,840	5,710	5,820
Imports (round)	690	530	1,690	1,470
Total PMUS	4,020	4,370	7,400	7,290
Tunas				
Hawaii landings	9,300	12,190	17,500	23,210
Imports (round)	960	950	1,834	2,730
Total tunas	10,260	13,140	19,334	25,940
Totals				
Total Hawaii pelagics	12,630	16,030	23,210	29,030
(excluding aku)	8,940	11,610	19,007	24,149
Total pelagic imports	1,650	1,480	3,524	4,200
Total	14,280	17,510	26,734	33,230

Table 7.--Species composition and revenue of pelagic species landed in Hawaii, 1987-88. Estimates are based on the shoreside monitoring program of the National Marine Fisheries Service.

Common name	Landings by species (in 1,000 pounds)		Revenue (US$1,000's)	
	1987	1988	1987	1988
Pelagic management unit species (PMUS)				
Blue marlin	951	1,023	892	854
Striped marlin	691	1,349	947	1,472
Other billfish	208	342	523	473
Mahimahi	1,023	565	2,253	1,715
Ono (wahoo)	411	445	1,024	1,185
Other PMUS	47	120	68	124
Other pelagics (excluding tunas)	183	233	316	328
Total PMUS	3,331	3,844	5,707	5,823
Tunas				
Bigeye tuna	1,903	3,062	6,769	9,773
Yellowfin tuna	3,358	3,995	5,965	7,593
Albacore tuna	337	706	544	955
Skipjack tuna	3,694	4,422	4,203	4,881
Other tunas	12	7	22	8
Total tunas	9,304	12,192	17,503	23,210

Table 8.--Hawaii pelagic landings (in 1,000 pounds) by gear type, 1987-88. Estimates are based on the shoreside monitoring program of the National Marine Fisheries Service.

	1987 landings				1988 landings			
	Total	Longline	Troll and handline	Other	Total	Longline	Troll and handline	Other
Pelagic management unit species (PMUS)								
Blue marlin	951	112	836	3	1,023	226	794	3
Striped marlin	691	598	93	0	1,349	1,112	235	2
Other billfish	208	152	55	1	342	205	137	0
Mahimahi	1,023	46	956	21	565	39	518	8
Ono (wahoo)	411	53	265	93	445	90	247	108
Other PMUS	47	43	4	0	120	95	24	1
Other pelagics (excluding tunas)	183	182	1	0	233	224	8	1
								0
Total PMUS	3,331	1,004	2,209	118	3,844	1,767	1,955	122
Tunas								
Bigeye tuna	1,903	1,793	96	14	3,062	2,738	321	3
Yellowfin tuna	3,358	583	2,741	34	3,995	1,312	2,382	301
Albacore	337	328	9	0	706	678	27	1
Skipjack tuna	3,694	3	209	3,482	4,422	15	366	4,041
Other tunas	12	0	11	1	7	0	6	1
Total tunas	9,304	2,707	3,066	3,531	12,192	4,743	3,102	4,347

Table 9.--Hawaii pelagic species prices, 1988 (price in US$ per pound, ex-vessel). Market includes imports (in round) and landings by unspecified gear types.

Common name	Market	Longline	Trolling and handline
Pelagic management unit species (PMUS)			
Blue marlin	0.90	0.85	0.92
Striped marlin	1.11	1.08	1.23
Other billfish	1.41	2.02	0.45
Mahimahi	3.18	2.79	3.23
Ono (wahoo)	2.77	2.69	2.77
Other PMUS	1.05	1.08	0.87
Imports	1.12	NA	NA
Total PMUS	1.74	1.29	1.68
Tunas			
Bigeye tuna	3.23	3.35	1.94
Yellowfin tuna	2.05	2.50	1.64
Albacore	1.36	1.34	1.83
Skipjack tuna	1.11	0.75	1.21
Imports	2.87	NA	NA
Total tunas	2.00	2.82	1.62

Table 10.--Hawaii's fresh-frozen pelagic seafood imports in 1988, as compiled by the NMFS Market News.

Common name	Pelagic imports (in pounds)		
	Round	Fillet	Total
Pelagic management unit species (PMUS)			
Mahimahi	8,963	2,618,728	2,627,691
Shark	351		351
Swordfish	1,290		1,290
Wahoo	520,899		520,899
Total PMUS	531,503	2,618,728	3,150,231
Tunas			
Bonito	10,404		10,404
Albacore	1,373		1,373
Bigeye tuna	159,971	15,000	174,971
Bluefin tuna	353		353
Skipjack tuna	217,735	72,023	289,758
Yellowfin tuna	555,962	125,940	681,901
Other	2,298		2,298
Total tunas	948,096	212,962	1,161,058

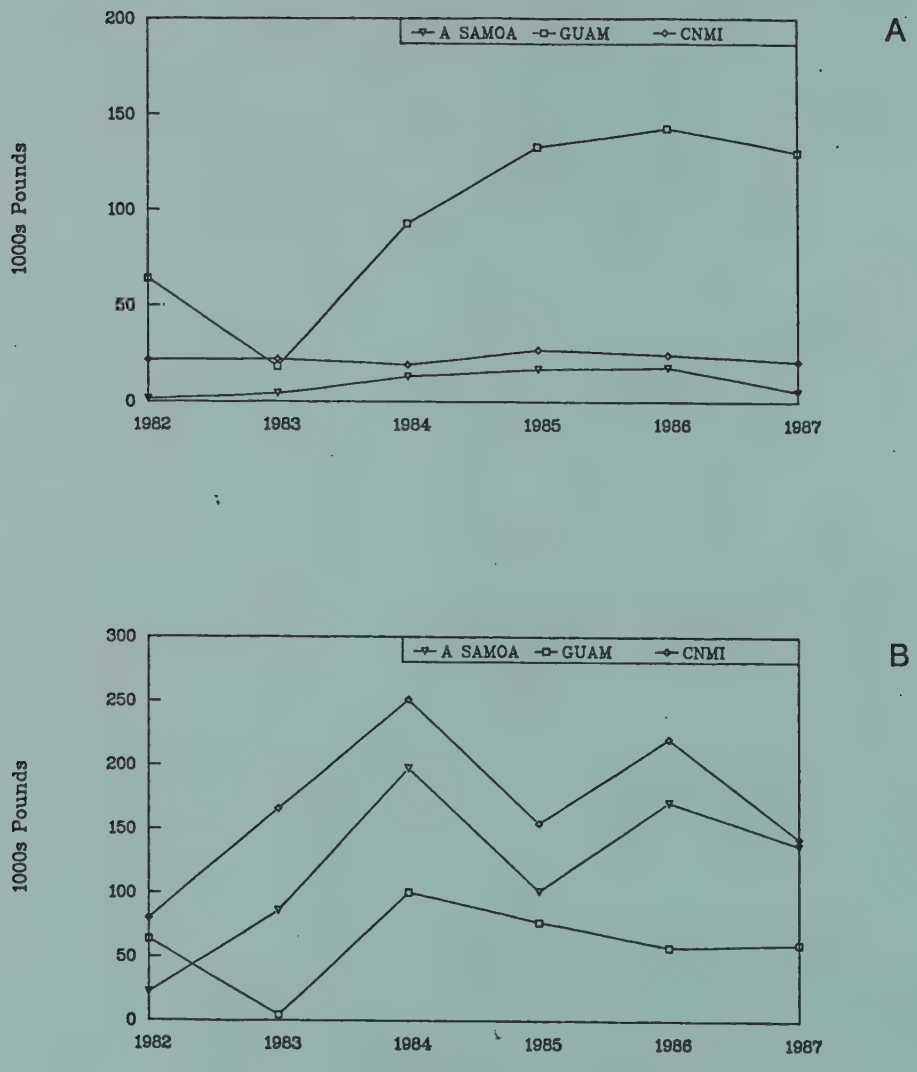


Figure 1.--Trends in 1982-87 commercial landings: (A) pelagic management unit species and (B) tunas in American Samoa, Guam, and the Commonwealth of the Northern Mariana Islands (from Hamm and Quach 1989).

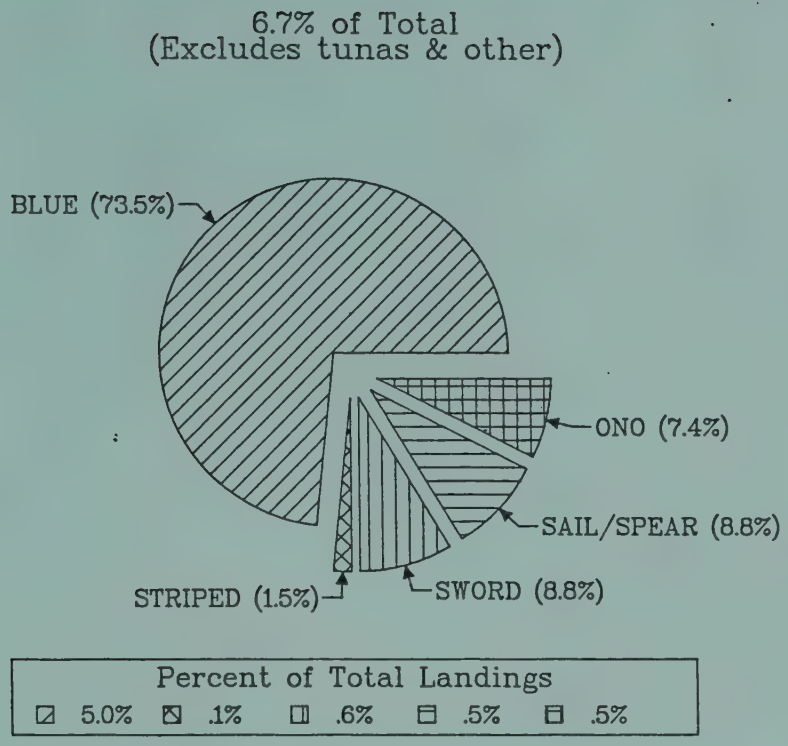
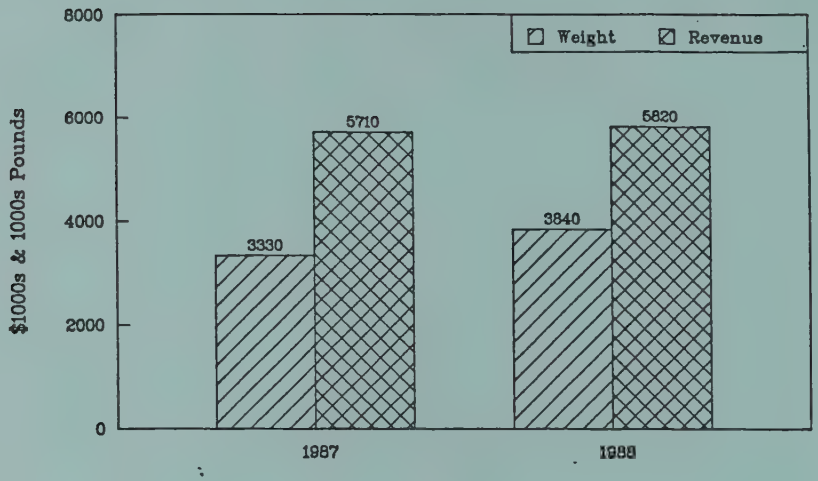


Figure 2.--Species composition of pelagic management unit species (percentage of PMUS and of total catch) in 1987, landed by the foreign longline fleet in American Samoa.



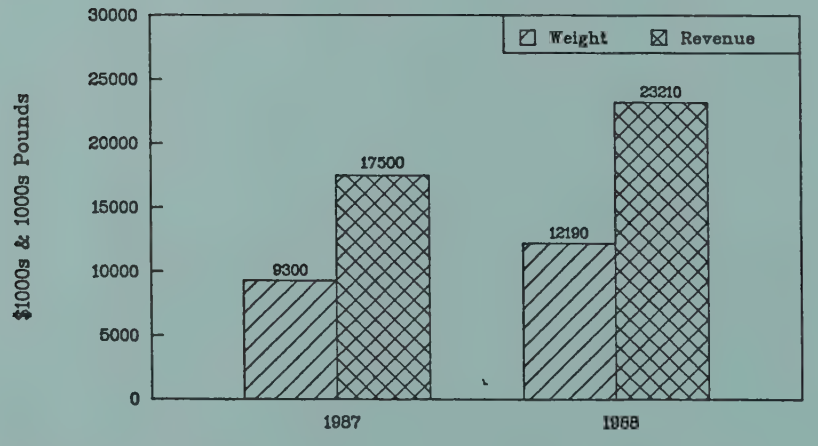


Figure 3.--Weight (in 1,000 pounds) and revenue (in US$1,000) of (A) pelagic management unit species and (B) tunas landed in Hawaii, 1987-88. (Data from shoreside monitoring.)

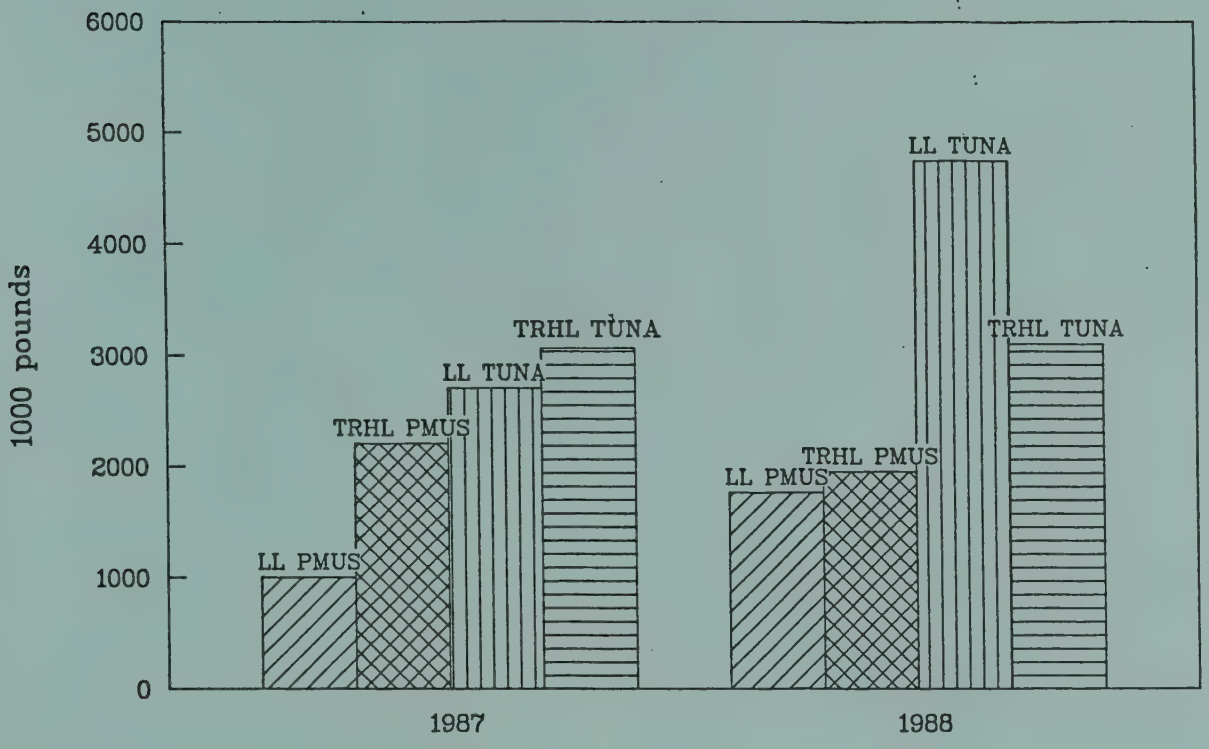


Figure 4.--Hawaii's pelagic landings by gear type, 1987-88 (excluding aku boats and Northwestern Hawaiian Islands) (LL = longline; TRHL = troll and handline).

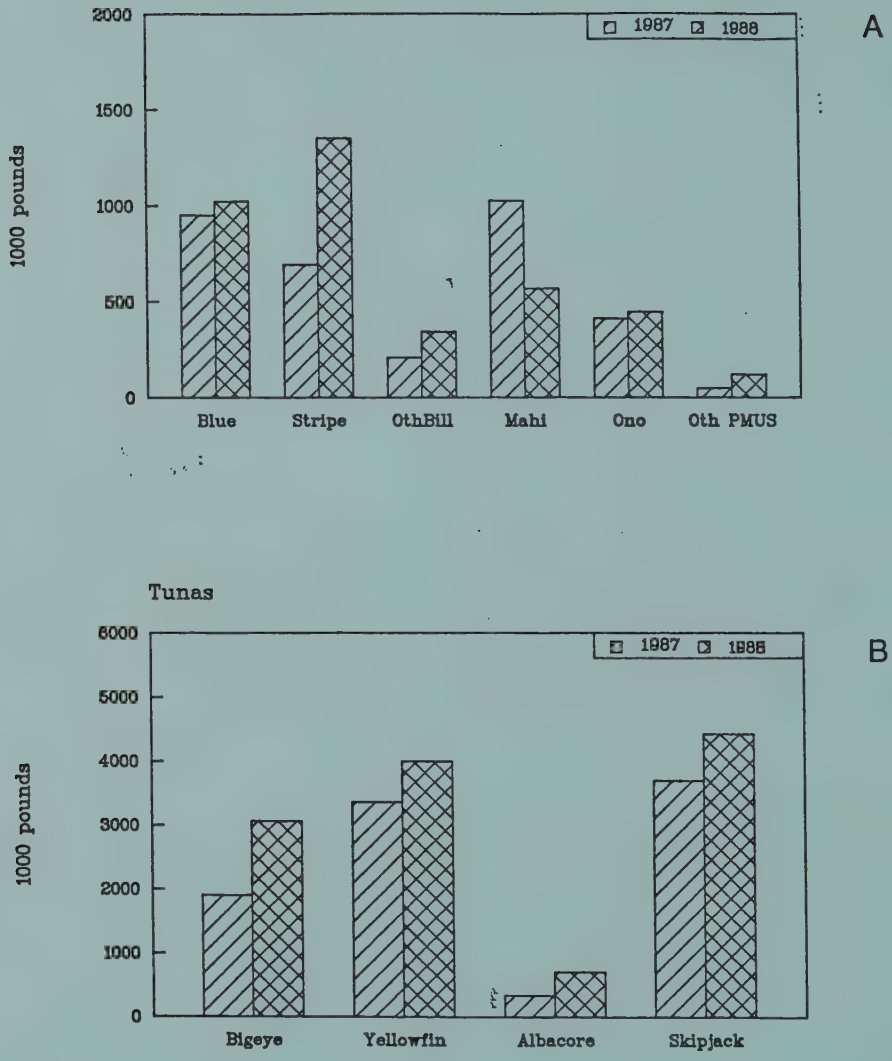


Figure 5.--Hawaii's pelagic species composition in 1987-88: (A) pelagic management unit species and (B) tunas.

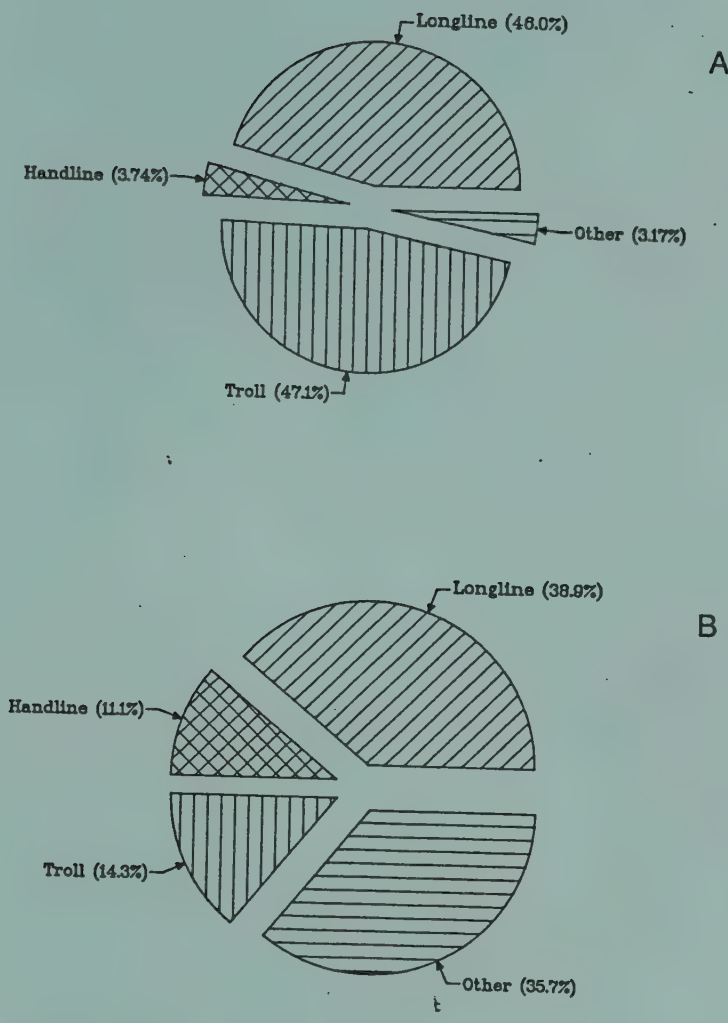
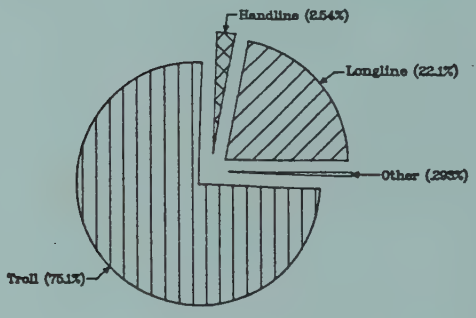


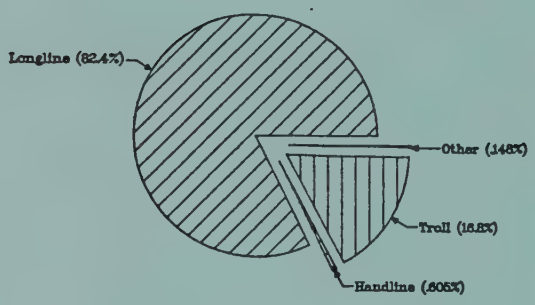
Figure 6.--Hawaii's pelagic gear shares in 1988: (A) pelagic management unit species, (B) tunas.

C

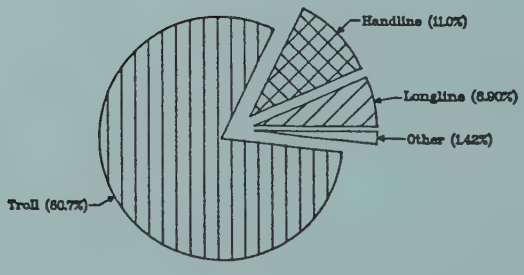
Blue Marlin, 1988



Striped Marlin, 1988



Mahimahi, 1988



Ono (wahoo), 1988

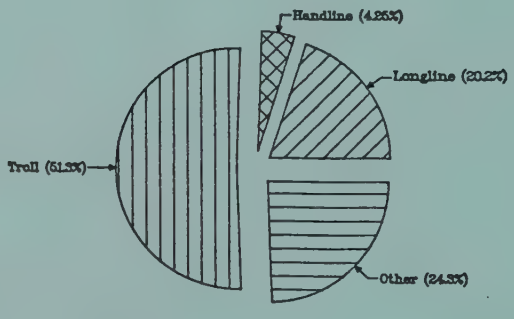
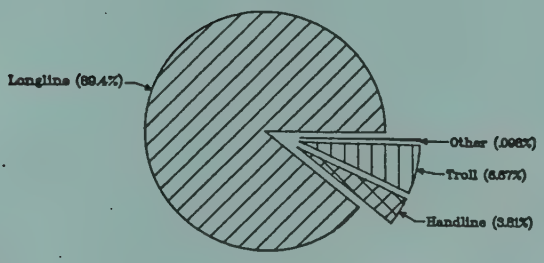


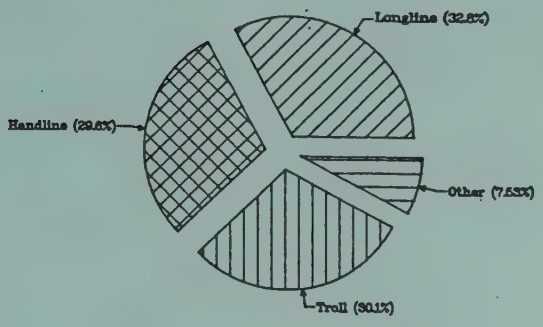
Figure 6.--Continued. (C) Individual PMUS.

D

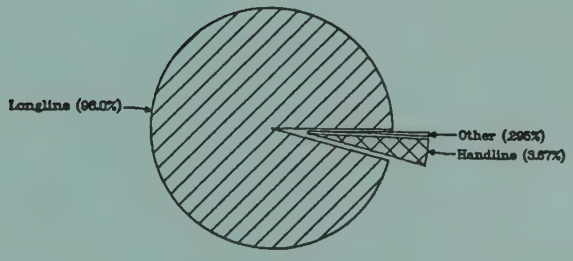
Bigeye tuna, 1988



Yellowfin tuna, 1988



Albacore tuna, 1988



Skipjack tuna, 1988

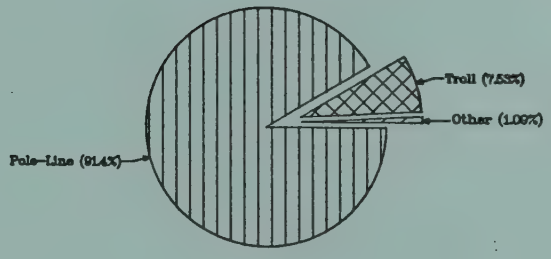


Figure 6.--Continued. (D) Individual tunas.

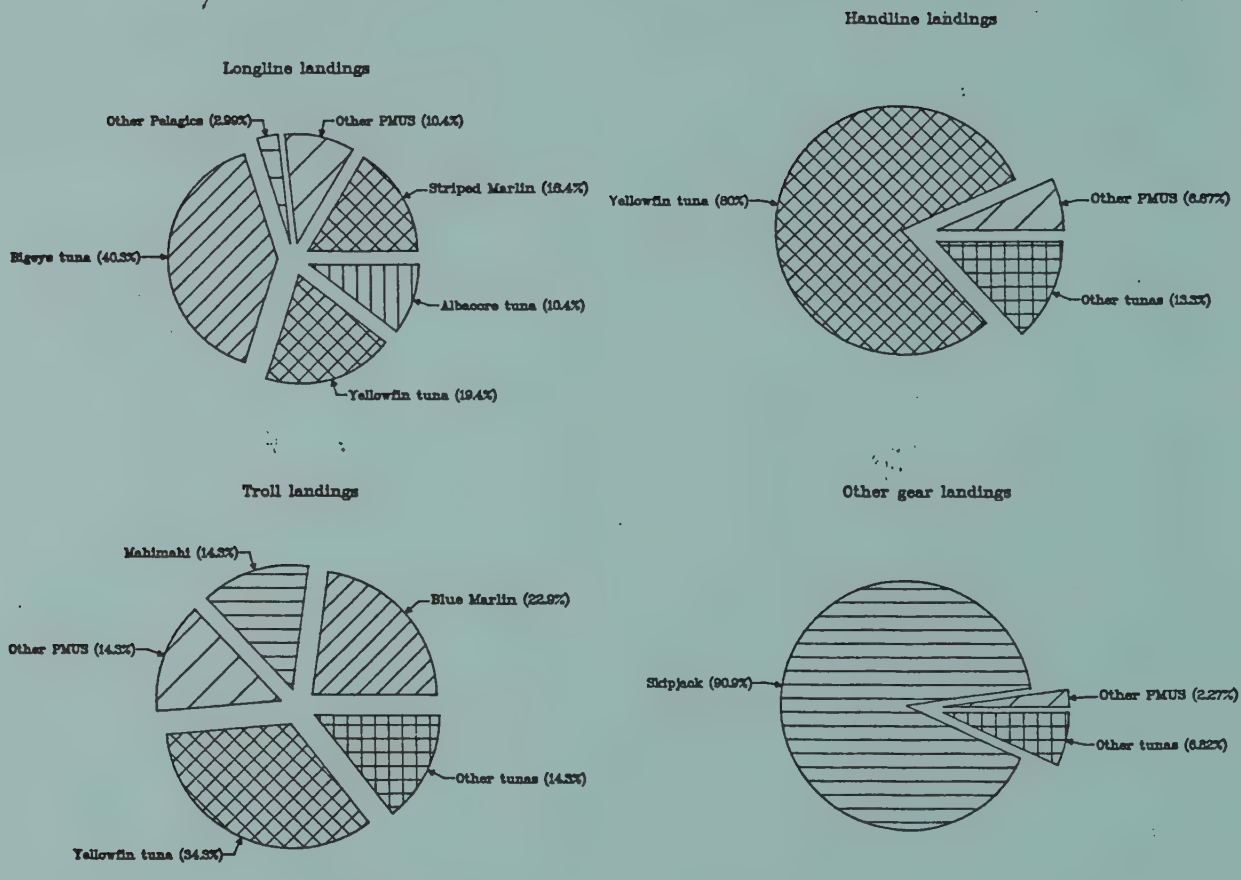


Figure 7.--Hawaii's gear shares in 1988 of primary pelagic species groups.

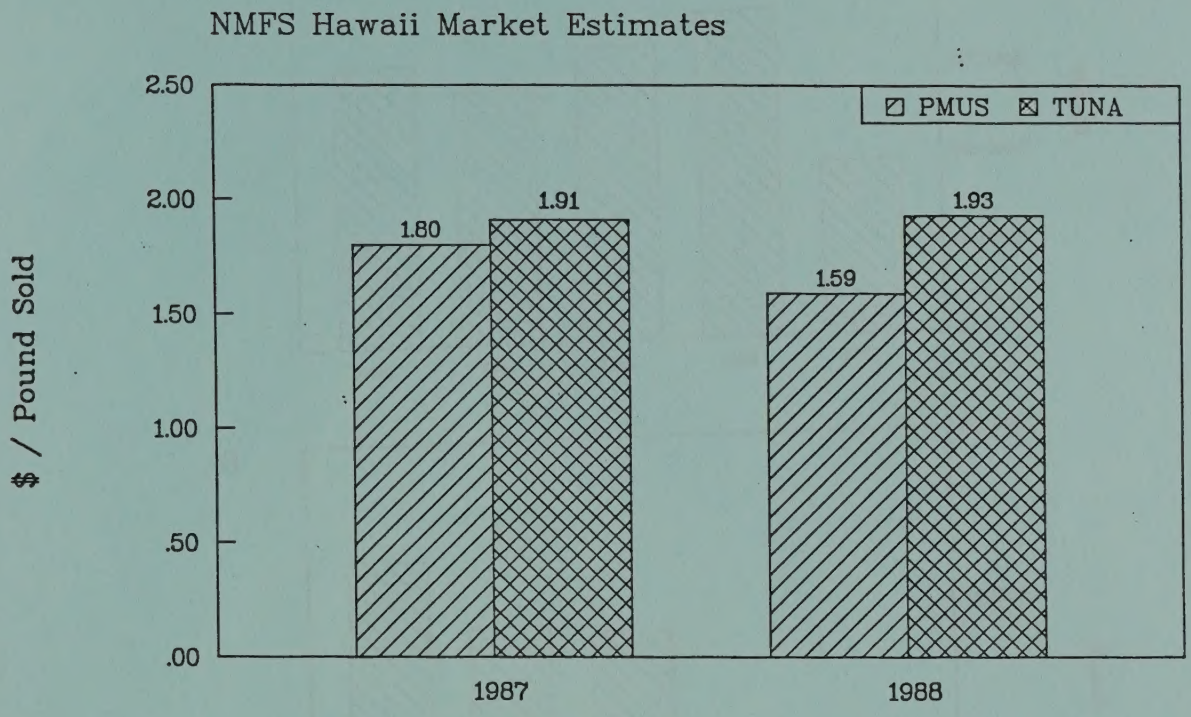


Figure 8.--Hawaii's pelagic prices in 1987-88.

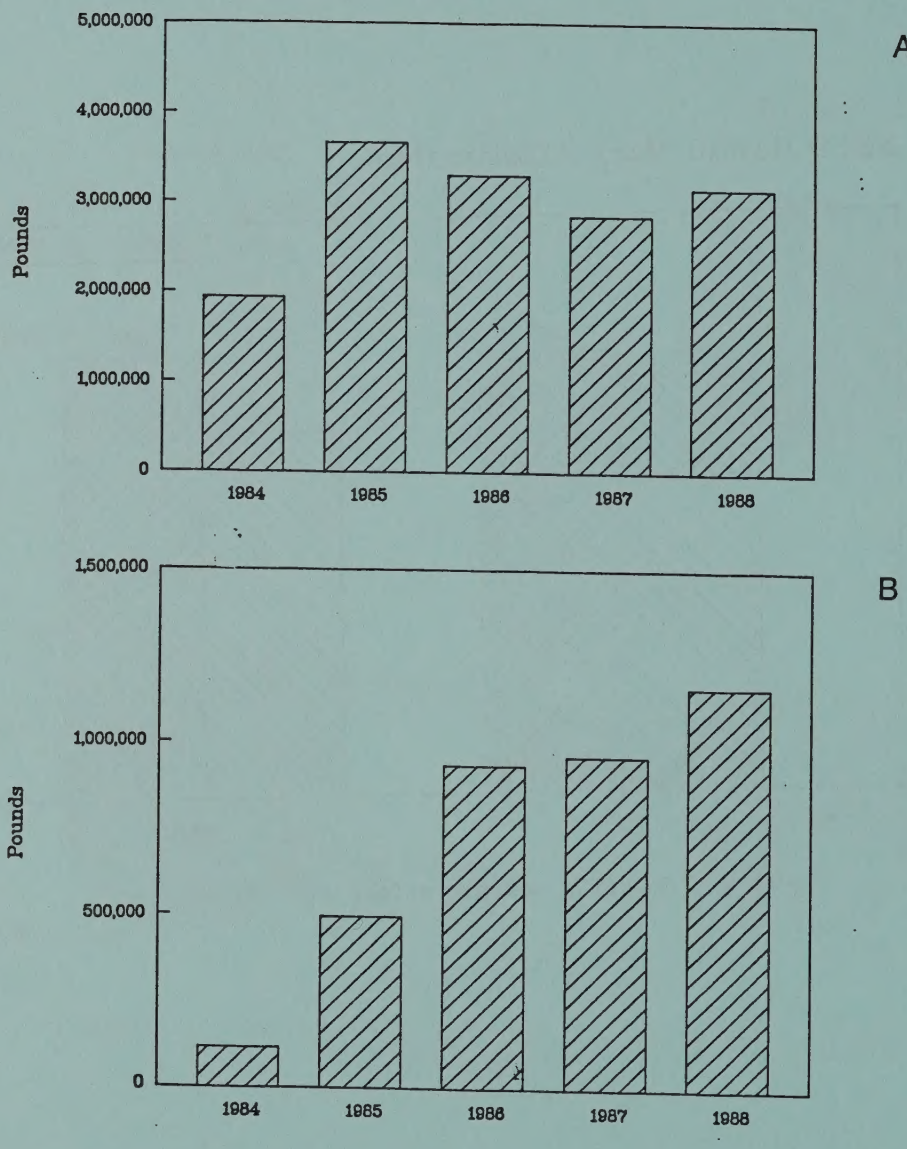


Figure 9.--Hawaii's imports (includes fillets and processed) in 1984-88: (A) pelagic management unit species and (B) tunas.